

The following rules are referenced in the preceding table:

- a) Activity_life_cycle;
- b) Actual_or_intended_effectivity;
- c) Approval_status_constraint;
- d) External_source_product_definition_correlation;
- e) External_source_product_definition_correlation;
- f) Facility_and_material_life_cycle;
- g) Plant_functional_layered_item;
- h) Product_definition_life_cycle.

5.2 AIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources (and the AICs) and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the text for constructs that are imported from the integrated resources (and the AICs). The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes that are not imported into the AIM. Requirements stated in the integrated resources that refer to such items and subtypes apply exclusively to those items that are imported into the AIM. (*)

EXPRESS specification:

```
*)  
SCHEMA plant_functional_data;  
  
USE FROM action_schema -- ISO~10303-41 (with proposed extensions)  
(action,  
 action_method,  
 action_method_relationship,  
 action_relationship,  
 action_resource);  
  
USE FROM application_context_schema -- ISO~10303-41  
(application_protocol_definition,  
 library_context,  
 product_context,  
 product_definition_context);  
  
USE FROM approval_schema -- ISO~10303-41 (with proposed extensions)  
(approval,  
 approval_status);
```

```

USE FROM date_time_schema -- ISO~10303-41
(date_and_time);

USE FROM document_schema -- ISO~10303-41
(document);

USE FROM draughting_element_schema -- ISO~10303-101
(draughting_callout,
draughting_callout_relationship,
leader_curve,
leader_directed_callout,
leader_terminator,
projection_curve,
projection_directed_callout,
terminator_symbol);

USE FROM drawing_definition_schema -- ISO~10303-101
(draughting_title,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage);

USE FROM effectivity_schema -- ISO~10303-41 (with proposed extensions)
(dated_effectivity,
effectivity,
effectivity_relationship); -- proposed new entity

USE FROM external_reference_schema -- ISO~10303-41
(externally_defined_item,
external_source,
pre_defined_item);

USE FROM geometry_schema -- ISO~10303-42
(axis2_placement_2d,
b_spline_curve_with_knots,
bezier_curve,
cartesian_point,
circle,
composite_curve,
curve,
direction,
ellipse,
geometric_representation_context,
geometric_representation_item,
hyperbola,
line,
offset_curve_2d,
parabola,
point,
point_on_curve,
polyline,
quasi_uniform_curve,

```

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```
rational_b_spline_curve,
trimmed_curve,
uniform_curve);

USE FROM group_schema -- ISO~10303-41
(group,
group_relationship);

USE FROM management_resources_schema -- ISO~10303-41 (with proposed extensions)
(action_assignment,
approval_assignment,
document_reference,
effectivity_assignment,
external_identification_assignment, -- proposed new entity
identification_assignment, -- proposed new entity
group_assignment,
library_assignment,
name_assignment,
organization_assignment,
person_assignment);

USE FROM material_property_definition_schema -- ISO~10303-45
(property_definition_relationship);

USE FROM measure_schema; -- ISO~10303-41

USE FROM method_definition_schema -- ISO~10303-49
(process_or_process_relationship_effectivity,
serial_action_method);

USE FROM person_organization_schema -- ISO~10303-41
(organization,
organization_relationship,
organizational_address,
person,
person_and_organization,
personal_address);

USE FROM presentation_appearance_schema -- ISO~10303-46
(box_height,
box_rotate_angle,
box_slant_angle,
box_width,
context_dependent_invisibility,
curve_style,
curve_style_font,
externally_defined_curve_font,
externally_defined_hatch_style,
externally_defined_tile_style,
fill_area_style,
fill_area_style_colour,
fill_area_style_hatching,
```

```

fill_area_style_tile_symbol_with_style,
fill_area_style_tiles,
pre_defined_curve_font,
styled_item,
symbol_colour,
symbol_style,
text_style,
text_style_for_defined_font,
text_style_with_box_characteristics,
text_style_with_mirror);

USE FROM presentation_definition_schema -- ISO~10303-46
(annotation_curve_occurrence,
annotation_fill_area,
annotation_fill_area_occurrence,
annotation_occurrence,
annotation_occurrence_relationship,
annotation_symbol,
annotation_symbol_occurrence,
annotation_text,
annotation_text_occurrence,
annotation_text_with_extent,
composite_text,
composite_text_with_associated_curves,
composite_text_with_blanking_box,
composite_text_with_extent,
defined_symbol,
externally_defined_symbol,
pre_defined_symbol,
symbol_representation,
symbol_representation_map,
symbol_target,
text_alignment,
text_literal,
text_literal_with_associated_curves,
text_literal_with_blanking_box,
text_literal_with_delineation,
text_literal_with_extent);

USE FROM presentation_organization_schema -- ISO~10303-46
(graphical_transformation,
presentation_area,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation,
presentation_representation_relationship,
presentation_size,
presentation_view,
presented_item,
presented_item_representation);

USE FROM presentation_resource_schema -- ISO~10303-46

```

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```
(colour_rgb,
externally_defined_text_font,
font_select,
planar_box,
planar_extent,
pre_defined_colour,
pre_defined_text_font);

USE FROM process_property_representation_schema -- ISO~10303-49
(action_property_representation);

USE FROM process_property_schema -- ISO~10303-49
(action_property,
action_property_relationship);

USE FROM product_definition_schema -- ISO~10303-41 (with proposed extensions)
(product_definition,
product_category,
product_category_relationship,
product_definition_effectivity,
product_definition_relationship,
product_definition_with_associated_documents,
product_related_product_category);

USE FROM product_property_definition_schema -- ISO~10303-41 (with proposed
-- extensions)
(property_definition,
characterized_object,
product_definition_shape,
shape_aspect,
shape_aspect_relationship);

USE FROM product_property_representation_schema -- ISO~10303-41
(property_definition_representation);

USE FROM product_structure_schema -- ISO~10303-44
(product_definition_usage,
assembly_component_usage,
assembly_component_usage_substitute,
next_assembly_usage_occurrence,
specified_higher_usage_occurrence);

USE FROM qualified_measure_schema -- ISO~10303-45
(descriptive_representation_item,
measure_representation_item,
qualified_representation_item,
type_qualifier);

USE FROM representation_schema -- ISO~10303-43
(mapped_item,
representation,
representation_item,
```

```
representation_relationship);
(*
```

NOTES

1 – The schemas referenced above can be found in the following parts of ISO 10303:

action_schema	ISO 10303-41
application_context_schema	ISO 10303-41
approval_schema	ISO 10303-41
date_time_schema	ISO 10303-41
document_schema	ISO 10303-41
draughting_elements_schema	ISO 10303-101
drawing_definition_schema	ISO 10303-101
effectivity_schema	ISO 10303-41
external_reference_schema	ISO 10303-41
geometry_schema	ISO 10303-42
group_schema	ISO 10303-41
management_resources_schema	ISO 10303-41
material_property_definition_schema	ISO 10303-45
measure_schema	ISO 10303-41
method_definition_schema	ISO 10303-49
person_organization_schema	ISO 10303-41
presentation_appearance_schema	ISO 10303-46
presentation_definition_schema	ISO 10303-46
presentation_organization_schema	ISO 10303-46
presentation_resource_schema	ISO 10303-46
process_property_representation_schema	ISO 10303-49
process_property_schema	ISO 10303-49
product_definition_schema	ISO 10303-41
product_property_definition_schema	ISO 10303-41
product_property_representation_schema	ISO 10303-41
product_structure_schema	ISO 10303-44
qualified_measure_schema	ISO 10303-45
representation_schema	ISO 10303-43

2 – Modifications and extensions to schemas in ISO 10303 part 41 and ISO 10303 part 49 are required to support the Information Requirements that are stated in clause 4 of this part of ISO 10303.

The proposed extensions are described in ISO TC184/SC4 document ‘Proposed extensions to ISO 10303 parts 41 and 49 to support process plant functional data’. The plans to progress these proposed extensions as an ISO New Work Item are stated in the Foreword to this part of ISO 10303.

5.2.1 Fundamental concepts and assumptions

5.2.1.1 Actual and intended objects

Clause 4.2 of this part of ISO 10303 identifies requirements for the life-cycle characterization of objects as either actual (existing or having existed) or intended (to exist in the future). This requirement is satisfied within this clause by specifying, where appropriate, that the value of a **description** attribute of

an entity data type is ‘actual’ or ‘intended’. This is specified using informal propositions for each entity data type affected.

NOTE 1 – Informal propositions are used to allow for extensibility by users, or in a subsequent edition of this standard.

5.2.1.2 Alternate identification

Clause 4.2 of this part of ISO 10303 identifies requirements for multiple or alternate identification of objects. The schema defined in this clause satisfies these requirements as follows.

If the object that is identified is a facility or a material, the identification of the object is given by **product_definition.id**. If there are two or more identifications for the object, the second (and subsequent) identification is given by **product_definition_for_identification.id**. An organization that is responsible for such an identification, or makes use of it, is associated with the relevant **product_definition** by a **plant_functional_organization_assignment** with the role ‘identification scheme maintainer’ or ‘identification scheme user’, respectively.

5.2.1.3 Standard, externally defined, and user defined classes

Clause 4.2 of this part of ISO 10303 identifies requirements for the specification of classes. The EXPRESS schema specified in this clause satisfies these requirements and additionally identifies three mechanisms for specification of classes. These mechanisms are:

- specification of the name and definition of the class within this part of ISO 10303: these are referred to as ‘standard’ classes;
- specification of the name and definition of the class within some identified source of information: these are referred to as ‘externally defined’ classes;
- specification of the name and definition of the class within an exchange conforming to this part of ISO 10303: these are referred to as ‘user defined’ classes.

For each type of class specified in this clause, three entity data types are defined:

class_of_xxxx: identifies a ‘user defined’ class;

standard_class_of_xxxx: identifies a ‘standard’ class; these standard classes are fully specified in annex M of this part of ISO 10303;

externally_defined_class_of_xxxx: identifies an ‘externally defined’ class, by specifying the source of the class definition.

For each type of class definition, the appropriate **description** attribute may be used to characterize the nature of the class.

EXAMPLE 254 – An instance of **class_of_facility** may have the name ‘reciprocating pump’ and the description ‘UK English class name’ indicating the natural language in which the class name is specified.

5.2.1.4 Typical and specific facilities and materials

Clause 4.2 of this part of ISO 10303 identifies requirements for the distinction between facilities and materials, and between typical and specific instances of these. The EXPRESS schema specified in this clause satisfies these requirements through the specification of standard values for the **name** attribute of the **application_context_element** that is referenced as the **frame_of_reference** of a **product_definition**. These standard values are as follows:

- ‘functional occurrence’ specifies that a **product_definition** a Facility (see 4.2.89) and a Specific_object (see 4.2.168);
- ‘functional definition’ specifies that a **product_definition** a Facility (see 4.2.89) and a Typical_object (see 4.2.178);
- ‘physical occurrence’ specifies that a **product_definition** a Material object (see 4.2.110) and a Specific_object (see 4.2.168);
- ‘physical definition’ specifies that a **product_definition** a Material object (see 4.2.110) and a Typical_object (see 4.2.178).

NOTE 1 – These standard values are the same as, and are intended to carry the same meaning as, those specified in clause 5.2 of ISO 10303-227.²⁾

5.2.2 Plant functional type definitions

5.2.2.1 activity_performer_item

An **activity_performer_item** is a **person**, **organization**, or **product_definition** that is a Performer (see annex M, instance 537) of an Activity.

EXPRESS specification:

```
* )
TYPE activity_performer_item = SELECT
  (person,
   organization,
   product_definition);
END_TYPE;
(*
```

5.2.2.2 annotation_element_item

An **annotation_element_item** identifies the **annotation_occurrence**, **presentation_representation**, **drawing_revision**, **presentation_layer_assignment** or **symbol_representation** that is assigned to a **class_of_annotation_element**.

EXPRESS specification:

²⁾To be published

```
* )
TYPE annotation_element_item = SELECT
(annotation_occurrence,
drawing_revision,
presentation_layer_assignment,
presentation_representation,
symbol_representation);
END_TYPE;
(*
```

5.2.2.3 approval_effectivity_item

An **approval_effectivity_item** identifies a **plant_functional_approval_assignment** that is assigned to an effectivity.

EXPRESS specification:

```
* )
TYPE approval_effectivity_item = SELECT
(plant_functional_approval_assignment);
END_TYPE;
(*)
```

5.2.2.4 approval_item

An **approval_item** identifies the aspects of product data that may be assigned to an **approval**.

EXPRESS specification:

```
* )
TYPE approval_item = SELECT -- list extended 5/11/96
(action,
action_assignment,
action_method,
action_property,
action_relationship,
annotation_fill_area,
annotation_occurrence,
annotation_occurrence_relationship,
annotation_symbol,
annotation_text,
approval_status,
assembly_component_usage_substitute,
axis2_placement_2d,
class_of_facility,
class_of_facility_assembly_constraint,
class_of_facility_connection_constraint,
class_of_material,
class_of_material_assembly_constraint,
class_of_material_connection_constraint,
classification_of_class_of_facility,
classification_of_class_of_material,
classification_of_facility,
```

classification_of_material,
colour_rgb,
composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,

```
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE;
(*
```

5.2.2.5 assessment_purpose_item

An **assessment_purpose_item** identifies the **action**, **action_method**, or **class_of_activity** that is the purpose for an Assess (see annex M, instance 1) Activity.

EXPRESS specification:

```
*)
TYPE assessment_purpose_item = SELECT
  (action,
   action_method,
   class_of_activity);
END_TYPE;
(*)
```

5.2.2.6 assessment_result_item

An **assessment_result_item** identifies the **effectivity** that is the result of an Assess (see annex M, instance 1) Activity.

EXPRESS specification:

```
*)
TYPE assessment_result_item = SELECT
  (effectivity);
END_TYPE;
(*)
```

5.2.2.7 class_of_activity_item

A **class_of_activity_item** identifies the **action** or **action_method** that is assigned to a **class_of_activity**.

EXPRESS specification:

```
*)
TYPE class_of_activity_item = SELECT
  (action,
   action_method);
END_TYPE;
(*)
```

5.2.2.8 class_of_annotation_element_library_item

A **class_of_annotation_element_library_item** identifies the **class_of_annotation_element** that is assigned to a library of such classes.

EXPRESS specification:

```
* )
TYPE class_of_annotation_element_library_item = SELECT
  (class_of_annotation_element);
END_TYPE;
(*
```

5.2.2.9 class_of_facility_library_item

A **class_of_facility_library_item** identifies the **class_of_facility** that is assigned to a library of such classes.

EXPRESS specification:

```
* )
TYPE class_of_facility_library_item = SELECT
  (class_of_facility);
END_TYPE;
(*)
```

5.2.2.10 class_of_information_content_library_item

A **class_of_information_content_library_item** identifies the **class_of_information_content** that is assigned to a library of such classes.

EXPRESS specification:

```
* )
TYPE class_of_information_content_library_item = SELECT
  (class_of_information_content);
END_TYPE;
(*)
```

5.2.2.11 class_of_involvement_item

A **class_of_involvement_item** identifies the **process_product_association**, **process_property_association**, **plant_functional_organization_assignment**, or **plant_functional_person_assignment** that is assigned to a **class_of_property**.

EXPRESS specification:

```
* )
TYPE class_of_involvement_item = SELECT
  (plant_functional_activity_performer_assignment,
   plant_functional_assessed_object_activity_assignment,
   plant_functional_assessment_purpose_activity_assignment,
   plant_functional_assessment_result_activity_assignment,
```

```
    plant_functional_design_reference_activity_assignment,
    plant_functional_design_result_activity_assignment,
    plant_functional_transfer_material_destination_activity_assignment,
    plant_functional_transfer_material_source_activity_assignment,
    plant_functional_transferred_material_activity_assignment,
    plant_functional_transform_material_input_activity_assignment,
    plant_functional_transform_material_output_activity_assignment);
END_TYPE;
(*
```

5.2.2.12 class_of_material_library_item

A **class_of_material_library_item** identifies the **class_of_material** that is assigned to a library of such classes.

EXPRESS specification:

```
*)
TYPE class_of_material_library_item = SELECT
  (class_of_material);
END_TYPE;
(*)
```

5.2.2.13 class_of_property_item

A **class_of_property_item** identifies the **property_definition** or **action_property** that is assigned to a **class_of_property**.

EXPRESS specification:

```
*)
TYPE class_of_property_item = SELECT
  (action_property,
   property_definition);
END_TYPE;
(*)
```

5.2.2.14 class_of_property_library_item

A **class_of_property_library_item** identifies the **class_of_property** that is assigned to a library of such classes.

EXPRESS specification:

```
*)
TYPE class_of_property_library_item = SELECT
  (class_of_property);
END_TYPE;
(*)
```

5.2.2.15 described_item

A **described_item** identifies the aspects of product data that may be described by members of a **class_of_information_content**.

EXPRESS specification:

```
*)  
TYPE described_item = SELECT  
(action,  
 action_assignment,  
 action_method,  
 action_property,  
 action_relationship,  
 annotation_fill_area,  
 annotation_occurrence,  
 annotation_occurrence_relationship,  
 annotation_symbol,  
 annotation_text,  
 approval_status,  
 assembly_component_usage_substitute,  
 class_of_activity,  
 class_of_facility,  
 class_of_facility_assembly_constraint,  
 class_of_facility_connection_constraint,  
 class_of_material,  
 class_of_material_assembly_constraint,  
 class_of_material_connection_constraint,  
 classification_of_class_of_facility,  
 classification_of_class_of_material,  
 classification_of_facility,  
 classification_of_material,  
 colour_rgb,  
 composite_text,  
 connection_of_facility,  
 connection_of_material,  
 curve,  
 date_and_time,  
 defined_symbol,  
 descriptive_representation_item,  
 direction_range_for_connector_feature,  
 document,  
 document_reference,  
 drawing_revision,  
 drawing_sheet_revision,  
 drawing_sheet_revision_usage,  
 effectivity,  
 effectivity_assignment,  
 fill_area_style_hatching,  
 fill_area_style_tiles,  
 group,  
 group_assignment,  
 group_relationship,
```

```
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
axis2_placement_2d,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE;
(*
```

5.2.2.16 design_item

A **design_item** identifies the aspects of product data that may be referenced by, or be the result of, a Design (see annex M, instance 2) Activity.

EXPRESS specification:

```
*)
TYPE design_item = SELECT -- same list as approval_item
  (action,
   action_assignment,
   action_method,
```

action_property,
action_relationship,
annotation_fill_area,
annotation_occurrence,
annotation_occurrence_relationship,
annotation_symbol,
annotation_text,
approval_status,
assembly_component_usage_substitute,
axis2_placement_2d,
class_of_facility,
class_of_facility_assembly_constraint,
class_of_facility_connection_constraint,
class_of_material,
class_of_material_assembly_constraint,
class_of_material_connection_constraint,
classification_of_class_of_facility,
classification_of_class_of_material,
classification_of_facility,
classification_of_material,
colour_rgb,
composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,

```

presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE;
(*

```

5.2.2.17 effectivity_item

An **effectivity_item** identifies an **action**, **action_method**, **assembly_of_facility**, **assembly_of_material**, **classification_of_class_of_facility**, **classification_of_class_of_material**, **classification_of_facility**, **classification_of_material**, **collection_of_facility**, **collection_of_material**, **connection_of_facility**, **connection_of_material**, **effectivity**, **plant_functional_class_of_annotation_element_assignment**, **plant_functional_class_of_information_content_assignment**, **plant_functional_class_of_involvement_assignment**, **plant_functional_property_classification_assignment**, **plant_functional_recognized_possession_of_property_assignment**, or **product_definition** that is assigned to an **effectivity**.

EXPRESS specification:

```

*)
TYPE effectivity_item = SELECT
  (action,
   action_method,
   assembly_of_facility,
   assembly_of_material,
   classification_of_class_of_facility,
   classification_of_class_of_material,
   classification_of_facility,
   classification_of_material,
   collection_of_facility,
   collection_of_material,
```

```

connection_of_facility,
connection_of_material,
effectivity,
plant_functional_class_of_annotation_element_assignment,
plant_functional_class_of_information_content_assignment,
plant_functional_class_of_involvement_assignment,
plant_functional_property_classification_assignment,
plant_functional_recognized_possession_of_property_assignment,
product_definition);
END_TYPE;
(*

```

5.2.2.18 hierarchy_context_item

A **hierarchy_context_item** identifies a **product_definition** that is used to provide the context for a hierarchy.

EXPRESS specification:

```

*)
TYPE hierarchy_context_item = SELECT
  (product_definition);
END_TYPE;
(*

```

5.2.2.19 identification_context_item

An **identification_context_item** identifies the **external_source** that provides the valid context for an identification.

EXPRESS specification:

```

*)
TYPE identification_context_item = SELECT
  (external_source);
END_TYPE;
(*

```

5.2.2.20 identified_item

An **identified_item** identifies those objects that may be identified by an **Information_content** (see 4.2.98).

EXPRESS specification:

```

*)
TYPE identified_item = SELECT
  (action, action_method, -- Activity
   class_of_activity,
   effectivity, -- Beginning_or_end_effect
   plant_functional_approval_assignment, -- Approval_of_object
   class_of_information_content,
   class_of_facility,
   class_of_involvement,

```

```
class_of_material,
class_of_material,
connection_of_facility,
connection_of_material,
product_definition, -- facility, material
shape_aspect, -- feature
specified_higher_usage_occurrence, -- Hierarchy_of_composition
information_content_representation, -- Information_content
organization,
person,
property_definition, -- property
provision_of_service);
END_TYPE;
(*
```

5.2.2.21 information_carrier_item

An **information_carrier_item** identifies the **product_definition** that is associated with a **class_of_information_content**.

EXPRESS specification:

```
*)
TYPE information_carrier_item = SELECT
  (product_definition);
END_TYPE;
(*)
```

5.2.2.22 information_content_item

An **information_content_item** identifies the **representation_context** that is associated with a **class_of_information_content**.

EXPRESS specification:

```
*)
TYPE information_content_item = SELECT
  (representation_context);
END_TYPE;
(*)
```

5.2.2.23 inherited_item

An **inherited_item** identifies an association that is inherited.

EXPRESS specification:

```
*)
TYPE inherited_item = SELECT
  (action_assignment,
   action_method_relationship,
   action_relationship,
   approval_assignment,
```

```

document_reference,
effectivity_assignment,
group_assignment,
library_assignment,
name_assignment,
organization_assignment,
person_assignment,
product_definition_relationship,
product_related_product_category, -- here to end added 5/12/96
property_definition_relationship,
representation_relationship,
shape_aspect_relationship);
END_TYPE;
(*

```

5.2.2.24 input_output_information_content_description_item

An **input_output_information_content_description_item** identifies a **plant_functional_class_of_object-description_constraint_assignment** that is the input or output of an activity or class of activity.

EXPRESS specification:

```

*)
TYPE input_output_information_content_description_item = SELECT
  (plant_functional_class_of_object_description_constraint_assignment);
END_TYPE;
(*

```

5.2.2.25 input_output_property_possession_item

An **input_output_property_possession_item** identifies a **plant_functional_recognized_possession_of_property_assignment** that is the input or output of an activity or class of activity.

EXPRESS specification:

```

*)
TYPE input_output_property_possession_item = SELECT
  (plant_functional_recognized_possession_of_property_assignment);
END_TYPE;
(*

```

5.2.2.26 involved_class_item

An **involved_class_item** identifies the **class_of_material** or **class_of_facility** that is assigned to a **class-of_involvement**.

EXPRESS specification:

```

*)
TYPE involved_class_item = SELECT
  (class_of_facility,
   class_of_material);

```

```
END_TYPE;  
(*
```

5.2.2.27 item_for_presentation

An **item_for_presentation** identifies an item that is presented.

EXPRESS specification:

```
*)  
TYPE item_for_presentation = SELECT  
  (action, action_method, -- activity  
   connection_of_facility,  
   connection_of_material,  
   effectivity, -- beginning_or_end_effect  
   information_content_representation, -- information content  
   product_definition, -- facility, material, facility port  
   shape_aspect); -- feature  
END_TYPE;  
(*
```

5.2.2.28 named_item

A **named_item** identifies the aspects of product data with which a **name** is associated.

EXPRESS specification:

```
*)  
TYPE named_item = SELECT -- same list as approval_item  
  (action,  
   action_assignment,  
   action_method,  
   action_property,  
   action_relationship,  
   annotation_fill_area,  
   annotation_occurrence,  
   annotation_occurrence_relationship,  
   annotation_symbol,  
   annotation_text,  
   approval_status,  
   assembly_component_usage_substitute,  
   axis2_placement_2d,  
   class_of_facility,  
   class_of_facility_assembly_constraint,  
   class_of_facility_connection_constraint,  
   class_of_material,  
   class_of_material_assembly_constraint,  
   class_of_material_connection_constraint,  
   classification_of_class_of_facility,  
   classification_of_class_of_material,  
   classification_of_facility,  
   classification_of_material,  
   colour_rgb,
```

composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,

```
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE;
(*
```

5.2.2.29 organization_item

An **organization_item** identifies the **product_definition**, **product_category**, **product_definition_relationship**, **action_resource** or **external_source** with which an **organization** is associated.

EXPRESS specification:

```
*)
TYPE organization_item = SELECT
  (action_resource,
   external_source,
   product_category,
   product_definition,
   product_definition_relationship,
   specified_higher_usage_occurrence);
END_TYPE;
(*)
```

5.2.2.30 person_item

A **person_item** identifies the **action_resource** with which a **person** is associated.

EXPRESS specification:

```
*)
TYPE person_item = SELECT
  (action_resource);
END_TYPE;
(*)
```

5.2.2.31 possessed_class_of_property_item

A **possessed_class_of_property_item** identifies the **class_of_material**, **class_of_facility** or **class_of_activity** that is associated with a **class_of_property**.

EXPRESS specification:

```
*)
TYPE possessed_class_of_property_item = SELECT
  (class_of_activity,
   class_of_facility,
   class_of_material);
END_TYPE;
(*)
```

5.2.2.32 presented_facility_class_item

A **presented_facility_class_item** identifies the **class_of_facility** whose members may be presented by a **class_of_annotation_element**.

EXPRESS specification:

```
* )
TYPE presented_facility_class_item = SELECT
  (class_of_facility);
END_TYPE;
(*
```

5.2.2.33 presented_material_class_item

A **presented_material_class_item** identifies the **class_of_material** whose members may be presented by a **class_of_annotation_element**.

EXPRESS specification:

```
* )
TYPE presented_material_class_item = SELECT
  (class_of_material);
END_TYPE;
(*)
```

5.2.2.34 symbol_library_item

A **symbol_library_item** identifies a **symbol_representation** that is assigned to a library.

EXPRESS specification:

```
* )
TYPE symbol_library_item = SELECT
  (symbol_representation);
END_TYPE;
(*)
```

5.2.2.35 transfer_material_item

A **transfer_material_item** is a **product_definition** that is a transferred material for a Transfer_material (see annex M, instance 3) Activity.

EXPRESS specification:

```
* )
TYPE transfer_material_item = SELECT
  (product_definition);
END_TYPE;
(*)
```

5.2.2.36 transfer_source_destination_item

A **transfer_source_destination_item** identifies the **product_definition** that is the source or destination for a Transfer_material (see annex M, instance 3) Activity.

EXPRESS specification:

```
* )
TYPE transfer_source_destination_item = SELECT
  (product_definition);
END_TYPE;
(*
```

5.2.2.37 transform_material_item

A **transform_material_item** identifies the **product_definition** that is the input or output of a Transform_material (see annex M, instance 4) Activity.

EXPRESS specification:

```
* )
TYPE transform_material_item = SELECT
  (product_definition);
END_TYPE;
(*)
```

5.2.2.38 typical_facility_catalogue_item

A **typical_facility_catalogue_item** identifies a **product_definition** that is assigned to a catalogue.

EXPRESS specification:

```
* )
TYPE typical_facility_catalogue_item = SELECT
  (product_definition);
END_TYPE;
(*)
```

5.2.2.39 typical_material_catalogue_item

A **typical_material_catalogue_item** identifies a **product_definition** that is assigned to a catalogue.

EXPRESS specification:

```
* )
TYPE typical_material_catalogue_item = SELECT
  (product_definition);
END_TYPE;
(*)
```

5.2.3 Plant functional entity definitions

5.2.3.1 action_composition

An **action_composition** is a type of **action** and **action_relationship** that identifies a composition association between activities. This entity type satisfies the application specific information requirements stated in clause 4.2.57 of this part of ISO 10303, in the case when the composed activities are specific.

EXPRESS specification:

```
* )
ENTITY action_composition
SUBTYPE OF (action, action_relationship);
END_ENTITY;
(*
```

5.2.3.2 action_sequence

An **action_sequence** is a type of **action** and **action_relationship** that identifies a sequence association between activities. This entity type satisfies the application specific information requirements stated in clause 4.2.169 of this part of ISO 10303, in the case when the sequenced activities are specific.

EXPRESS specification:

```
* )
ENTITY action_sequence
SUBTYPE OF (action, action_relationship);
END_ENTITY;
(*)
```

5.2.3.3 action_method_composition

An **action_method_composition** is a type of **action_method** and **action_method_relationship** that identifies a composition association between activities. This entity type satisfies the application specific information requirements stated in clause 4.2.57 of this part of ISO 10303, in the case when the composed activities are typical.

EXPRESS specification:

```
* )
ENTITY action_method_composition
SUBTYPE OF (action_method, action_method_relationship);
END_ENTITY;
(*)
```

5.2.3.4 action_method_sequence

An **action_method_sequence** is a type of **action_method** and **action_method_relationship** that identifies a sequence association between activities. This entity type satisfies the application specific information requirements stated in clause 4.2.169 of this part of ISO 10303, in the case when the sequenced activities are typical.

EXPRESS specification:

```
* )
ENTITY action_method_sequence
SUBTYPE OF (action_method, action_method_relationship);
END_ENTITY;
(*
```

5.2.3.5 alternate_connection_identification

An **alternate_connection_identification** is a **product_definition_relationship** that provides an alternative identification for a **connection_of_facility** or a **connection_of_material**. This alternative identification is provided by the **name** attribute of the **alternate_connection_identification**. An **alternate_connection_identification** is valid only as a relationship between two **product_definition** instances that are also related using **connection_of_material** or **connection_of_facility**.

This entity type satisfies the application specific information requirements stated in clause 4.2.96 of this part of ISO 10303, in the case where the identified object is a connection.

EXPRESS specification:

```
* )
ENTITY alternate_connection_identification
SUBTYPE OF (product_definition_relationship);
WHERE
WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF.relating_product_definition,
'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
'RELATING_PRODUCT_DEFINTION') |
((SIZEOF (TYPEOF (pdr) *
[ 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL',
'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY']) = 1) AND
(pdr.related_product_definition ::=
SELF.related_product_definition))
)) = 1;
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **alternate_connection_identification** shall relate **product_definition** instances that are also related by a **connection_of_material** or a **connection_of_facility**.

5.2.3.6 assembly_of_facility

An **assembly_of_facility** is a type of **assembly_component_usage** and **product_definition** that relates a constituent facility to an assembled facility. This entity type satisfies the application specific information requirements stated in clause 4.2.18 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY assembly_of_facility
SUBTYPE OF (assembly_component_usage, product_definition);
WHERE
```

```

WR1: SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name IN
    ['functional definition','functional occurrence'];
WR2: SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name IN
    ['functional definition','functional occurrence'];
WR3: (SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name <>
    'functional definition') OR
(SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name =
    'functional definition');
WR4: (SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name <>
    'functional occurrence') OR
(SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name =
    'functional occurrence');

END_ENTITY;
(*

```

Formal propositions:

WR1: The **relating_product_definition** of an **assembly_of_facility** shall be facility.

WR2: The **related_product_definition** of an **assembly_of_facility** shall be a facility.

WR3: If the **relating_product_definition** of an **assembly_of_facility** is a typical facility, then the **related_product_definition** shall be a typical facility.

WR4: If the **relating_product_definition** of an **assembly_of_facility** is a specific facility, then the **related_product_definition** shall be a specific facility.

Informal propositions:

IP1: If the **description** of the **assembly_of_facility** has the value ‘actual’, then the **assembly_of_facility** exists or has existed.

IP2: If the **description** of the **assembly_of_facility** has the value ‘intended’, then the **assembly_of_facility** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.7 assembly_of_material

An **assembly_of_material** is a type of **assembly_component_usage** and **product_definition** that relates a constituent material object to an assembled material object. This entity type satisfies the application specific information requirements stated in clause 4.2.19 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY assembly_of_material

```

```
SUBTYPE OF (assembly_component_usage,product_definition);
WHERE
  WR1: SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name IN
    ['physical definition','physical occurrence'];
  WR2: SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name IN
    ['physical definition','physical occurrence'];
  WR3: (SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name <>
    'physical definition') OR
    (SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name =
    'physical definition');
  WR4: (SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name <>
    'physical occurrence') OR
    (SELF\product_definition_relationship.
    related_product_definition.frame_of_reference.name =
    'physical occurrence');
END_ENTITY;
(*
```

Formal propositions:

WR1: The **relating_product_definition** of an **assembly_of_material** shall be a material object.

WR2: The **related_product_definition** of an **assembly_of_material** shall be a material object.

WR3: If the **relating_product_definition** of an **assembly_of_material** is a typical material, then the **related_product_definition** shall be a typical material.

WR4: If the **relating_product_definition** of an **assembly_of_material** is a specific material, then the **related_product_definition** shall be a specific material.

Informal propositions:

IP1: If the **description** of the **assembly_of_material** has the value ‘actual’, then the **assembly_of_material** exists or has existed.

IP2: If the **description** of the **assembly_of_material** has the value ‘intended’, then the **assembly_of_material** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.8 binary_object_representation

A **binary_object_representation** is a type of **representation** that provides references to externally defined data that is binary in nature.

EXPRESS specification:

*)

```

ENTITY binary_object_representation
SUBTYPE OF (representation);
WHERE
  WR1: SELF.context_of_items.context_type = 'binary object representation';
  WR2: SIZEOF (QUERY (item <* SELF.items |
    NOT (
      'PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_REPRESENTATION_ITEM'
      IN TYPEOF (item)
    ))) = 0;
END_ENTITY;
(*

```

Formal propositions:

WR1: The **context_type** of **representation_context** of a **binary_object_representation** shall be ‘binary object representation’

WR2: Every **item** in a **binary_object_representation** shall be an **externally_defined_representation-item**.

5.2.3.9 class_of_activity

A **class_of_activity** is a type of **group** that is a class of activities. Activities (**action** or **action_method**) are assigned to a class by **plant_functional_class_of_activity_assignment**. A **class_of_activity** may be a **standard_class_of_activity** or an **externally_defined_class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.24 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY class_of_activity
  SUPERTYPE OF (ONEOF (standard_class_of_activity,
                        externally_defined_class_of_activity))
  SUBTYPE OF (group);
END_ENTITY;
(*

```

5.2.3.10 class_of_annotation_element

A **class_of_annotation_element** is a type of **group** that is a class of annotation elements. Annotation elements are assigned to a class by **plant_functional_class_of_annotation_assignment** assignment. A **class_of_annotation_element** may be a **standard_class_of_annotation_element** or an **externally-defined_class_of_annotation_element**. This entity type satisfies the application specific information requirements stated in clause 4.2.25 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY class_of_annotation_element
  SUPERTYPE OF (ONEOF (standard_class_of_annotation_element,
                        externally_defined_class_of_annotation_element))
  SUBTYPE OF (group);

```

```
END_ENTITY;  
(*
```

5.2.3.11 class_of_annotation_element_assembly_constraint

A **class_of_annotation_element_assembly_constraint** is a type of **group_relationship** that specifies a valid assembly between members of classes of annotation element. This entity type satisfies the application specific information requirements stated in clause 4.2.141 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY class_of_annotation_element_assembly_constraint  
  SUPERTYPE OF (ONEOF (  
    externally_defined_class_of_annotation_element_assembly_constraint))  
  SUBTYPE OF (group_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF\group_relationship.relating_group);  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF\group_relationship.related_group);  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **relating_group** of a **class_of_annotation_element_assembly_constraint** shall be a **class_of_annotation_element**.

WR2: The **related_group** of a **class_of_annotation_element_assembly_constraint** shall be a **class_of_annotation_element**.

5.2.3.12 class_of_annotation_element_connection_constraint

A **class_of_annotation_element_connection_constraint** is a type of **group_relationship** that specifies a valid connection between members of classes of annotation element. This entity type satisfies the application specific information requirements stated in clause 4.2.147 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY class_of_annotation_element_connection_constraint  
  SUPERTYPE OF (ONEOF (  
    externally_defined_class_of_annotation_element_connection_constraint))  
  SUBTYPE OF (group_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF\group_relationship.relating_group);  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF\group_relationship.related_group);  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **relating_group** of a **class_of_annotation_element_connection_constraint** shall be a **class_of_annotation_element**.

WR2: The **related_group** of a **class_of_annotation_element_connection_constraint** shall be a **class_of_annotation_element**.

5.2.3.13 class_of_annotation_element_presentation_of_facility_constraint_assignment

A **class_of_annotation_element_presentation_of_facility_constraint_assignment** is a type of **group_assignment** that assigns a **class_of_annotation_element** to a **class_of_facility** to indicate that members of the latter may be presented by members of the former.

EXPRESS specification:

```
*)  
ENTITY class_of_annotation_element_presentation_of_facility_constraint_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF presented_facility_class_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF.assigned_group);  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **class_of_facility** instances whose members may be presented by members of the assigned **class_of_annotation_element**.

Formal propositions:

WR1: The **assigned_group** of a **class_of_annotation_element_presentation_of_facility_constraint_assignment** shall be a **class_of_annotation_element**.

5.2.3.14 class_of_annotation_element_presentation_of_material_constraint_assignment

A **class_of_annotation_element_presentation_of_material_constraint_assignment** is a type of **group_assignment** that assigns a **class_of_annotation_element** to a **class_of_material** to indicate that members of the latter may be presented by members of the former.

EXPRESS specification:

```
*)  
ENTITY class_of_annotation_element_presentation_of_material_constraint_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF presented_material_class_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN  
    TYPEOF (SELF.assigned_group);
```

```
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **class_of_material** instances whose members may be presented by members of the assigned **class_of_annotation_element**.

Formal propositions:

WR1: The **assigned_group** of a **class_of_annotation_element_presentation_of_material_constraint_assignment** shall be a **class_of_annotation_element**.

5.2.3.15 class_of_facility_assembly_constraint

A **class_of_facility_assembly_constraint** is a type of **product_category_relationship** specifies a valid assembly between members of classes of facility. This entity type satisfies the application specific information requirements stated in clause 4.2.142 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY class_of_facility_assembly_constraint  
  SUPERTYPE OF (ONEOF (  
    externally_defined_class_of_facility_assembly_constraint))  
  SUBTYPE OF (product_category_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
    TYPEOF (SELF\product_category_relationship.category);  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
    TYPEOF (SELF\product_category_relationship.sub_category);  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **category** of a **class_of_facility_assembly_constraint** shall be a **class_of_facility**.

WR2: The **sub_category** of a **class_of_facility_assembly_constraint** shall be a **class_of_facility**.

5.2.3.16 class_of_facility_connection_constraint

A **class_of_facility_connection_constraint** is a type of **product_category_relationship** specifies a valid connection between members of classes of facility. This entity type satisfies the application specific information requirements stated in clause 4.2.148 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY class_of_facility_connection_constraint  
  SUPERTYPE OF (ONEOF (  
    externally_defined_class_of_facility_connection_constraint))  
  SUBTYPE OF (product_category_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN
```

```

    TYPEOF (SELF\product_category_relationship.category);
WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN
    TYPEOF (SELF\product_category_relationship.sub_category);
END_ENTITY;
(*

```

Formal propositions:

WR1: The **category** of a **class_of_facility_connection_constraint** shall be a **class_of_facility**.

WR2: The **sub_category** of a **class_of_facility_connection_constraint** shall be a **class_of_facility**.

5.2.3.17 class_of_facility

A **class_of_facility** is a type of **product_category** and **characterized_object** that identifies the nature of a facility. A **class_of_facility** may be a **standard_class_of_facility** or an **externally_defined_class_of_facility**. This entity type satisfies the application specific information requirements stated in clause 4.2.26 of this part of ISO 10303.

NOTE 1 – A **class_of_facility** is defined as a **characterized_object** so that properties may be associated with the class.

EXPRESS specification:

```

*) ENTITY class_of_facility
  SUPERTYPE OF (ONEOF (standard_class_of_facility,
                        externally_defined_class_of_facility))
  SUBTYPE OF (product_category, characterized_object);
END_ENTITY;
(*

```

5.2.3.18 class_of_information_content

A **class_of_information_content** indicates either the nature of the information that a user may obtain from an **information_content**, the language of the **information_content**, or the format of the **information_content**. This entity type satisfies the application specific information requirements stated in clause 4.2.27 of this part of ISO 10303.

EXPRESS specification:

```

*) ENTITY class_of_information_content
  SUPERTYPE OF (ONEOF (standard_class_of_information_content,
                        externally_defined_class_of_information_content))
  SUBTYPE OF (group);
WHERE
  WRI1: (SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
                           'PLANT_FUNCTIONAL_CLASS_OF_INFORMATION_' +
                           'CONTENT_ASSIGNMENT.ITEMS')) +
          SIZEOF (QUERY (gr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
                                         'GROUP_RELATIONSHIP.RELATING_GROUP') |
                         ('PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT' IN

```

```
        TYPEOF (gr.related_group))) +  
SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  
'PLANT_FUNCTIONAL_CLASS_OF_INFORMATION_CONTENT_' +  
'LIBRARY_ASSIGNMENT.ITEMS'))  
) >= 1;  
END_ENTITY;  
(*
```

Formal propositions:

WR1: a **class_of_information_content** shall participate in at least one **class_of_information_content_assignment**, or as the **relating_group** in a **group_relationship** where the **related_group** is also a **class_of_information_content**, or in a **plant_functional_class_of_information_content_library_assignment**.

5.2.3.19 class_of_information_content_composition_constraint

A **class_of_information_content_composition_constraint** is a type of **group_relationship** that specifies a constraint on the composition of **class_of_information_content**. This entity type satisfies the application specific information requirements stated in clause 4.2.146 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY class_of_information_content_composition_constraint  
  SUBTYPE OF (group_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTION_SCHEMA.CLASS_OF_INFORMATION_CONTENT' IN  
    TYPEOF (SELF.relating_group);  
  WR2: 'PLANT_FUNCTION_SCHEMA.CLASS_OF_INFORMATION_CONTENT' IN  
    TYPEOF (SELF.related_group);  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\group_relationship.relating_group: The **information_content** that is the whole in the association.

SELF\group_relationship.related_group: The **information_content** that is the part in the association.

Formal propositions:

WR1: The **relating_group** in a **class_of_information_content_composition_constraint** shall be a **class_of_information_content**.

WR2: The **related_group** in a **class_of_information_content_composition_constraint** shall be a **class_of_information_content**.

5.2.3.20 class_of_involvement

A **class_of_involvement** is a type of **group** that is a class of involvements. Involvements are assigned to a class by **plant_functional_class_of_involvement_assignment**. A **class_of_involvement** may be a **stan-**

dard_class_of_involvement or a **externally_defined_class_of_involvement**. This entity type satisfies the application specific information requirements stated in clause 4.2.29 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY class_of_involvement
  SUPERTYPE OF (ONEOF (standard_class_of_involvement,
                        externally_defined_class_of_involvement))
  SUBTYPE OF (group);
END_ENTITY;
(*
```

5.2.3.21 class_of_material

A **class_of_material** is a type of **product_catagory** and **characterized_object** that identifies the nature of a material. A **class_of_material** may be a **standard_class_of_material** or an **externally_defined_class_of_material**. This entity type satisfies the application specific information requirements stated in clause 4.2.30 of this part of ISO 10303.

NOTE 1 – A **class_of_material** is defined as a **characterized_object** so that properties may be associated with the class.

EXPRESS specification:

```
* )
ENTITY class_of_material
  SUPERTYPE OF (ONEOF (standard_class_of_material,
                        externally_defined_class_of_material))
  SUBTYPE OF (product_category, characterized_object);
END_ENTITY;
(*)
```

5.2.3.22 class_of_material_assembly_constraint

A **class_of_material_assembly_constraint** is a type of **product_category_relationship** that specifies a valid assembly between members of classes of material. This entity type satisfies the application specific information requirements stated in clause 4.2.143 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY class_of_material_assembly_constraint
  SUPERTYPE OF (ONEOF (
    externally_defined_class_of_material_assembly_constraint))
  SUBTYPE OF (product_category_relationship);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\product_category_relationship.category);
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\product_category_relationship.sub_category);
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **category** of a **class_of_material_assembly_constraint** shall be a **class_of_material**.

WR2: The **sub_category** of a **class_of_material_assembly_constraint** shall be a **class_of_material**.

5.2.3.23 class_of_material_connection_constraint

A **class_of_material_connection_constraint** is a type of **product_category_relationship** that specifies a valid connection between members of classes of material. This entity type satisfies the application specific information requirements stated in clause 4.2.149 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY class_of_material_connection_constraint
  SUPERTYPE OF (ONEOF (
    externally_defined_class_of_material_connection_constraint))
  SUBTYPE OF (product_category_relationship);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\product_category_relationship.category);
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\product_category_relationship.sub_category);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **category** of a **class_of_material_connection_constraint** shall be a **class_of_material**.

WR2: The **sub_category** of a **class_of_material_connection_constraint** shall be a **class_of_material**.

5.2.3.24 class_of_property

A **class_of_property** is a type of **group** that is a class of properties. Properties are assigned to a class by **plant_functional_property_classification_assignment**. A **class_of_property** may be a **standard_class_of_property** or an **externally_defined_class_of_property**. This entity type satisfies the application specific information requirements stated in clause 4.2.31 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY class_of_property
  SUPERTYPE OF (ONEOF (standard_class_of_property,
    externally_defined_class_of_property))
  SUBTYPE OF (group);
END_ENTITY;
(*)
```

5.2.3.25 class_of_substance

A **class_of_substance** is a type of **class_of_material** that indicates the nature, structure and state of a substance that forms a material object. This entity type satisfies the application specific information requirements stated in clause 4.2.32 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY class_of_substance
  SUBTYPE OF (class_of_material);
END_ENTITY;
(*
```

5.2.3.26 classification_of_class_of_annotation_element

A **classification_of_class_of_annotation_element** is a type of **group_relationship** that associates a **class_of_annotation_element** with another **class_of_annotation_element**. A **classification_of_class_of_annotation_element** may be a **standard_classification_of_class_of_annotation_element** or an **externally_defined_classification_of_class_of_annotation_element**. This entity type satisfies the application specific information requirements stated in clause 4.2.35 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY classification_of_class_of_annotation_element
  SUPERTYPE OF (ONEOF (
    externally_defined_classification_of_class_of_annotation_element))
  SUBTYPE OF (group_relationship);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN
    TYPEOF (SELF\group_relationship.relating_group);
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN
    TYPEOF (SELF\group_relationship.related_group);
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group_relationship.relating_group: the **class_of_annotation_element** to which a second **class_of_annotation_element** is assigned.

SELF\group_relationship.related_group: the **class_of_annotation_element** that is assigned.

Formal propositions:

WR1: The **relating_group** of a **classification_of_class_of_annotation_element** shall be a **class_of_annotation_element**.

WR2: The **related_group** of a **classification_of_class_of_annotation_element** shall be a **class_of_annotation_element**.

5.2.3.27 classification_of_class_of_facility

A **classification_of_class_of_facility** is a type of **product_category_relationship** that associates a **class_of_facility** with another **class_of_facility**. A **classification_of_class_of_facility** may be a **standard_classification_of_class_of_facility** or an **externally_defined_classification_of_class_of_facility**. This entity type satisfies the application specific information requirements stated in clause 4.2.36 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY classification_of_class_of_facility  
  SUPERTYPE OF (ONEOF  
    (standard_classification_of_class_of_facility,  
     externally_defined_classification_of_class_of_facility))  
  SUBTYPE OF (product_category_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
    TYPEOF (SELF\product_category_relationship.category);  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
    TYPEOF (SELF\product_category_relationship.sub_category);  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\product_category_relationship.category: the **class_of_facility** to which a second **class_of_facility** is assigned.

SELF\product_category_relationship.sub_category: the **class_of_facility** that is assigned.

Formal propositions:

WR1: The **category** of a **classification_of_class_of_facility** shall be a **class_of_facility**.

WR2: The **sub_catagory** of a **classification_of_class_of_facility** shall be a **class_of_facility**.

5.2.3.28 classification_of_class_of_material

A **classification_of_class_of_material** is a type of **product_category_relationship** that associates a **class_of_material** with another **class_of_material**. A **classification_of_class_of_material** may be a **standard_classification_of_class_of_material** or an **externally_defined_classification_of_class_of_material**. This entity type satisfies the application specific information requirements stated in clause 4.2.37 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY classification_of_class_of_material  
  SUPERTYPE OF (ONEOF  
    (standard_classification_of_class_of_material,  
     externally_defined_classification_of_class_of_material))  
  SUBTYPE OF (product_category_relationship);  
WHERE
```

```

WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
      TYPEOF (SELF\product_category_relationship.category);
WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN
      TYPEOF (SELF\product_category_relationship.sub_category);
END_ENTITY;
(*

```

Attribute definitions:

SELF\product_category_relationship.category: the **class_of_material** to which a second **class_of_material** is assigned.

SELF\product_category_relationship.sub_category: the **class_of_material** that is assigned.

Formal propositions:

WR1: The **category** of a **classification_of_class_of_material** shall be a **class_of_material**.

WR2: The **sub_catagory** of a **classification_of_class_of_material** shall be a **class_of_material**.

5.2.3.29 classification_of_facility

A **classification_of_facility** is **product_related_product_category** that associates a **product** that is a facility and a **class_of_facility** and indicates that the facility is a member of the class. This entity type satisfies the application specific information requirements stated in clause 4.2.38 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY classification_of_facility
  SUBTYPE OF (product_related_product_category);
WHERE
  WR1: SELF.name = 'classifier';
  WR2: SIZEOF (QUERY (pcr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') |
    ((pcr.name = 'class assignment') AND
     ('PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN
      TYPEOF (pcr.sub_category)))
    )) >= 1;
  WR3: SIZEOF (SELF.products) = 1;
  WR4: SIZEOF (QUERY (pdf <* USEDIN (SELF.products[1],
    'PLANT_FUNCTIONAL_DATA.' +
    'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') |
    NOT (
      SIZEOF (QUERY (pd <* USEDIN (pdf,
        'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_DEFINITION.FORMATION') |
        NOT (
          pd\product_definition.frame_of_reference.name IN
          ['functional definition','functional occurrence']
        ))) = 0
      ))) = 0;
END_ENTITY;
(*

```

Formal propositions:

WR1: The name of the **classification_of_facility** shall be 'classifier'.

WR2: The **classification_of_facility** shall be the **category** in at least one **product_category_relationship**, which shall have the name 'class assignment' and have as **sub_category** a **class_of_facility**.

WR3: The **classification_of_facility** shall be related to exactly one **product**.

WR4: The **product** that is related to the **class_of_facility** shall be defined as a **facility**.

Informal propositions:

IP1: If the **description** of the **classification_of_facility** has the value 'actual', then the **classification_of_facility** exists or has existed.

IP2: If the **description** of the **classification_of_facility** has the value 'intended', then the **classification_of_facility** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_category** entity data type.

5.2.3.30 classification_of_material

A **classification_of_material** is **product_related_product_category** that associates a **product** that is a material object and a **class_of_material** and indicates that the material object is a member of the class. This entity type satisfies the application specific information requirements stated in clause 4.2.42 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY classification_of_material  
  SUBTYPE OF (product_related_product_category);  
WHERE  
  WR1: SELF.name = 'classifier';  
  WR2: SIZEOF (QUERY (pcr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') |  
    ((pcr.name = 'class assignment') AND  
     ('PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN  
      TYPEOF (pcr.sub_category)))  
   )) >= 1;  
  WR3: SIZEOF (SELF.products) = 1;  
  WR4: SIZEOF (QUERY (pdf <* USEDIN (SELF.products[1],  
    'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') |  
    NOT (  
      SIZEOF (QUERY (pd <* USEDIN (pdf,  
        'PLANT_FUNCTIONAL_DATA.' +  
        'PRODUCT_DEFINITION.FORMATION') |  
        NOT (  
          pd\product_definition.frame_of_reference.name IN  
          ['physical definition', 'physical occurrence'])  
        ))) = 0
```

```

    ) ) ) = 0 ;
END_ENTITY;
(*
```

Formal propositions:

WR1: The name of the **classification_of_material** shall be 'classifier'.

WR2: The **classification_of_material** shall be the **category** in at least one **product_category_relationship**, which shall have the name 'class assignment' and have as **sub_category** a **class_of_material**.

WR3: The **classification_of_material** shall be related to exactly one **product**.

WR4: The **product** that is related to the **class_of_material** shall be defined as a material.

Informal propositions:

IP1: If the **description** of the **classification_of_material** has the value 'actual', then the **classification_of_material** exists or has existed.

IP2: If the **description** of the **classification_of_material** has the value 'intended', then the **classification_of_material** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_category** entity data type.

5.2.3.31 collection_of_facility

A **collection_of_facility** is a type of **product_definition_usage** and **product_definition** that associates a part with a whole facility, but does not indicate that the part has a particular role within the whole. This entity type satisfies the application specific information requirements stated in clause 4.2.54 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY collection_of_facility  

  SUBTYPE OF (product_definition_usage,product_definition);  

WHERE  

  WR1: SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name IN  

    ['functional definition','functional occurrence'];  

  WR2: SELF\product_definition_relationship.  

    related_product_definition.frame_of_reference.name IN  

    ['functional definition','functional occurrence'];  

  WR3: (SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name <>  

    'functional definition') OR  

    (SELF\product_definition_relationship.  

    related_product_definition.frame_of_reference.name =  

    'functional definition');  

  WR4: (SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name <>  

    'functional occurrence') OR
```

```
(SELF\product_definition_relationship.  
related_product_definition.frame_of_reference.name =  
'functional occurrence');  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **relating_product_definition** of a **collection_of_facility** shall be a facility.

WR2: The **related_product_definition** of a **collection_of_facility** shall be facility.

WR3: If the **relating_product_definition** of a **collection_of_facility** is a typical facility, then the **related_product_definition** shall be a typical facility.

WR4: If the **relating_product_definition** of a **collection_of_facility** is a specific facility, then the **related_product_definition** shall be a specific facility.

Informal propositions:

IP1: If the **description** of the **collection_of_facility** has the value ‘actual’, then the **collection_of_facility** exists or has existed.

IP2: If the **description** of the **collection_of_facility** has the value ‘intended’, then the **collection_of_facility** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.32 collection_of_material

A **collection_of_material** is a type of **product_definition_usage** and **product_definition** that associates a part with a whole material object, but does not indicate that the part has a particular role within the whole. This entity type satisfies the application specific information requirements stated in clause 4.2.55 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY collection_of_material  
  SUBTYPE OF (product_definition_usage,product_definition);  
WHERE  
  WR1: SELF\product_definition_relationship.  
    relating_product_definition.frame_of_reference.name IN  
    ['physical definition','physical occurrence'];  
  WR2: SELF\product_definition_relationship.  
    related_product_definition.frame_of_reference.name IN  
    ['physical definition','physical occurrence'];  
  WR3: (SELF\product_definition_relationship.  
    relating_product_definition.frame_of_reference.name <>  
    'physical definition') OR  
    (SELF\product_definition_relationship.  
    related_product_definition.frame_of_reference.name =  
    'physical definition');
```

```

WR4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical occurrence') OR
      (SELF\product_definition_relationship.
       related_product_definition.frame_of_reference.name =
       'physical occurrence');
END_ENTITY;
(*

```

Formal propositions:

WR1: The **relating_product_definition** of a **collection_of_material** shall be a material.

WR2: The **related_product_definition** of a **collection_of_material** shall be a material.

WR3: If the **relating_product_definition** of a **collection_of_material** is a typical material, then the **related_product_definition** shall be a typical material. item [WR4] If the **relating_product_definition** of a **collection_of_material** is a specific material, then the **related_product_definition** shall be a specific material.

Informal propositions:

IP1: If the **description** of the **collection_of_material** has the value ‘actual’, then the **collection_of_material** exists or has existed.

IP2: If the **description** of the **collection_of_material** has the value ‘intended’, then the **collection_of_material** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.33 connection_of_facility

A **connection_of_facility** is a type of **product_definition_relationship** and **product_definition** that associates two facilities and indicates that one is connected to the other. This entity type satisfies the application specific information requirements stated in clause 4.2.65 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY connection_of_facility
  SUBTYPE OF (product_definition_relationship,product_definition);
  WHERE
    WR1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN
      ['functional definition','functional occurrence'];
    WR2: SELF\product_definition_relationship.
      related_product_definition.frame_of_reference.name IN
      ['functional definition','functional occurrence'];
    WR3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional definition') OR
      (SELF\product_definition_relationship.
       related_product_definition.frame_of_reference.name =

```

```
'functional definition');
WR4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional occurrence') OR
      (SELF\product_definition_relationship.
      related_product_definition.frame_of_reference.name =
      'functional occurrence');
WR5: SELF.relating_product_definition.description =
      SELF.related_product_definition.description;
END_ENTITY;
(*
```

Formal propositions:

WR1: The **relating_product_definition** of a **connection_of_facility** shall be a facility.

WR2: The **related_product_definition** of a

: connection_of_facility shall be a facility.

WR3: If the **relating_product_definition** of a **connection_of_facility** is a typical facility, then the **related_product_definition** shall be a typical facility.

WR4: If the **relating_product_definition** of a **connection_of_facility** is a specific facility, then the **related_product_definition** shall be a specific facility.

WR5: The **relating_product_definition** and the **related_product_definition** of a **connection_of_facility** shall have the same life-cycle stage ('intended' or 'actual');

Informal propositions:

IP1: If the **description** of the **connection_of_facility** has the value 'actual', then the **connection_of_facility** exists or has existed.

IP2: If the **description** of the **connection_of_facility** has the value 'intended', then the **connection_of_facility** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.
ssclauseconnection_of_material

A **connection_of_material** is a type of **product_definition_relationship** and **characterized_object** that associates two materials and indicates that one is connected to the other. This entity type satisfies the application specific information requirements stated in clause 4.2.66 of this part of ISO 10303.

NOTE 2 – A **connection_of_material** is defined as a **characterized_object** so that properties may be associated with the connection.

EXPRESS specification:

```
*)
ENTITY connection_of_material
  SUBTYPE OF (product_definition_relationship,characterized_object);
WHERE
  WR1: SELF\product_definition_relationship.
```

```

relating_product_definition.frame_of_reference.name IN
['physical definition', 'physical occurrence'];
WR2: SELF\product_definition_relationship.
related_product_definition.frame_of_reference.name IN
['physical definition', 'physical occurrence'];
WR3: (SELF\product_definition_relationship.
relating_product_definition.frame_of_reference.name <>
'physical definition') OR
(SELFL\product_definition_relationship.
related_product_definition.frame_of_reference.name =
'physical definition');
WR4: (SELFL\product_definition_relationship.
relating_product_definition.frame_of_reference.name <>
'physical occurrence') OR
(SELFL\product_definition_relationship.
related_product_definition.frame_of_reference.name =
'physical occurrence');
WR5: SELF.relating_product_definition.description =
SELF.related_product_definition.description;
END_ENTITY;
(*

```

Formal propositions:

WR1: The **relating_product_definition** of a **connection_of_material** shall be a material.

WR2: The **related_product_definition** of a **connection_of_material** shall be a material.

WR3: If the **relating_product_definition** of a **connection_of_material** is a typical material, then the **related_product_definition** shall be a typical material.

WR4: If the **relating_product_definition** of a **connection_of_material** is a specific material, then the **related_product_definition** shall be a specific material.

WR5: The **relating_product_definition** and the **related_product_definition** of a **connection_of_material** shall have the same life-cycle stage ('intended' or 'actual');

Informal propositions:

IP1: If the **description** of the **connection_of_material** has the value 'actual', then the **connection_of_material** exists or has existed.

IP2: If the **description** of the **connection_of_material** has the value 'intended', then the **connection_of_material** is intended to exist in the future.

NOTE 3 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.34 connection_shape_aspect

A **connection_shape_aspect** is a type of **shape_aspect** that identifies a feature of a material object that participates in a connection of material objects. This entity type satisfies the application specific information requirements stated in clause 4.2.90 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY connection_shape_aspect
  SUBTYPE OF (shape_aspect);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL' IN
    TYPEOF (SELF.of_shape.definition);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **connection_shape_aspect** shall be an aspect of the shape of a **connection_of_material**.

5.2.3.35 connector_feature_annotation_occurrence

A **connector_feature_annotation_occurrence** is a type of **annotation_occurrence** that defines a connector for another **annotation_occurrence**. This entity type satisfies the application specific information requirements stated in clause 4.2.67 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY connector_feature_annotation_occurrence
  SUBTYPE OF (annotation_occurrence);
WHERE
  WR1: SIZEOF (QUERY (aor <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'ANNOTATION_OCCURRENCE_RELATIONSHIP.' +
    'RELATED_ANNOTATION_OCCURRENCE') |
    'PLANT_FUNCTIONAL_DATA.POSSESSION_OF_CONNECTOR_FEATURE' IN
    TYPEOF (aor)
    )) >= 1;
END_ENTITY;
(*)
```

Formal propositions:

WR1: A **connector_feature_annotation_occurrence** shall be the **related_annotation_occurrence** of at least one **possession_of_feature_connector**.

5.2.3.36 direction_range_for_connector_feature

A **direction_range_for_connector_feature** is a type of **mapped_item** that specifies the range of orientations for a connector feature.

EXPRESS specification:

```
* )
ENTITY direction_range_for_connector_feature
  SUBTYPE OF (mapped_item);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.DIRECTION_RANGE_REPRESENTATION'
    IN TYPEOF (SELF.mapping_source.mapped_representation);
  WR2: 'PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'
```

```

    IN TYPEOF (SELF.mapping_target);
END_ENTITY;
(*

```

5.2.3.37 direction_range_representation

A **direction_range_representation** is a type of **representation** that defines the range of orientations for the connector feature of an annotation element.

EXPRESS specification:

```

*)  

ENTITY direction_range_representation  

  SUBTYPE OF (representation);  

WHERE  

  WR1: SIZEOF (SELF.items) = 2;  

  WR2: SIZEOF (QUERY (item <* SELF.items |  

    NOT ('PLANT_FUNCTIONAL_DATA.AXIS2_PLACEMENT_2D'  

      IN TYPEOF (item)  

    ))) = 0;  

  WR3: SIZEOF (QUERY (item <* SELF.items |  

    item\representation_item.name = 'from'  

  )) = 1;  

  WR4: SIZEOF (QUERY (item <* SELF.items |  

    item\representation_item.name = 'to'  

  )) = 1;  

END_ENTITY;  

(*

```

Formal propositions:

WR1: A **direction_range_representation** shall have exactly two items.

WR2: Each item in a **direction_range_representation** shall be an **axis2_placement_2d**.

WR3: Exactly one item in a **direction_range_representation** shall have the name ‘from’.

WR4: Exactly one item in a **direction_range_representation** shall have the name ‘to’.

5.2.3.38 external_source_product_definition_alias

An **external_source_product_definition_alias** is a type of **external_source** that provides a context for identification and relates this context, through equality of attribute values, to an instance of **product_definition**.

EXPRESS specification:

```

*)  

ENTITY external_source_product_definition_alias  

  SUBTYPE OF (external_source);  

WHERE  

  WR1: SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  

    'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1;

```

```
END_ENTITY;  
(*
```

Formal propositions:

WR1: Every **external_source_product_definition_alias** shall be the source for at least one **external_identification**.

5.2.3.39 externally_defined_class_of_activity

An **external_class_of_activity** is a type of **class_of_activity** that is defined by reference to an external source.

EXPRESS specification:

```
* )  
ENTITY externally_defined_class_of_activity  
  SUBTYPE OF (class_of_activity, externally_defined_item);  
WHERE  
  WR1: SELF\group.name = SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\group.name: the name of the **class_of_activity**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_activity** shall be given as specified in the external source.

5.2.3.40 externally_defined_class_of_annotation_element

An **external_class_of_annotation_element** is a type of **class_of_annotation_element** that is defined by reference to an external source.

EXPRESS specification:

```
* )  
ENTITY externally_defined_class_of_annotation_element  
  SUBTYPE OF (class_of_annotation_element, externally_defined_item);  
WHERE  
  WR1: SELF\group.name = SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\group.name: the name of the **class_of_annotation_element**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_annotation_element** shall be given as specified in the external source.

5.2.3.41 externally_defined_class_of_annotation_element_assembly_constraint

An **externally_defined_class_of_annotation_element_assembly_constraint** is a type of **class_of_annotation_element_assembly_constraint** that is defined by reference to an external source.

EXPRESS specification:

```
*)  
ENTITY externally_defined_class_of_annotation_element_assembly_constraint  
  SUBTYPE OF (class_of_annotation_element_assembly_constraint,  
              externally_defined_item);  
WHERE  
  WR1: SELF\group_relationship.name =  
        SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\group_relationship.name: the name of the **class_of_annotation_element_assembly_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_annotation_element_assembly_constraint** shall be given as specified in the external source.

5.2.3.42 externally_defined_class_of_annotation_element_connection_constraint

An **externally_defined_class_of_annotation_element_connection_constraint** is a type of **class_of_annotation_element_connection_constraint** that is defined by reference to an external source.

EXPRESS specification:

```
*)  
ENTITY externally_defined_class_of_annotation_element_connection_constraint  
  SUBTYPE OF (class_of_annotation_element_connection_constraint,  
              externally_defined_item);  
WHERE  
  WR1: SELF\group_relationship.name =  
        SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\group_relationship.name: the name of the **class_of_annotation_element_connection_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_annotation_element_connection_constraint** shall be given as specified in the external source.

5.2.3.43 externally_defined_class_of_facility_assembly_constraint

An **externally_defined_class_of_facility_assembly_constraint** is a type of **class_of_facility_assembly_constraint** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_facility_assembly_constraint
  SUBTYPE OF (class_of_facility_assembly_constraint,
               externally_defined_item);
WHERE
  WR1: SELF\product_category_relationship.name =
        SELF\externally_defined_item.item_id;
END_ENTITY;
(*
```

Attribute definitions:

SELF\product_category_relationship.name: the name of the **class_of_facility_assembly_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_facility_assembly_constraint** shall be given as specified in the external source.

5.2.3.44 externally_defined_class_of_facility_connection_constraint

An **externally_defined_class_of_facility_connection_constraint** is a type of **class_of_facility_connection_constraint** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_facility_connection_constraint
  SUBTYPE OF (class_of_facility_connection_constraint,
               externally_defined_item);
WHERE
  WR1: SELF\product_category_relationship.name =
        SELF\externally_defined_item.item_id;
END_ENTITY;
(*)
```

Attribute definitions:

SELF\product_category_relationship.name: the name of the **class_of_facility_connection_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_facility_connection_constraint** shall be given as specified in the external source.

5.2.3.45 externally_defined_class_of_facility

An **external_class_of_facility** is a type of **class_of_facility** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_facility
  SUBTYPE OF (class_of_facility, externally_defined_item);
WHERE
  WR1: SELF\product_category.name =
    SELF\externally_defined_item.item_id;
END_ENTITY;
(*
```

Attribute definitions:

SELF\product_category.name: the name of the **class_of_facility**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_facility** shall be given as specified in the external source.

5.2.3.46 externally_defined_class_of_information_content

An **external_class_of_information_content** is a type of **class_of_information_content** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_information_content
  SUBTYPE OF (class_of_information_content, externally_defined_item);
WHERE
  WR1: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group.name: the name of the **class_of_information_content**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_information_content** shall be given as specified in the external source.

5.2.3.47 externally_defined_class_of_involvement

An **external_class_of_involvement** is a type of **class_of_involvement** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_involvement
  SUBTYPE OF (class_of_involvement, externally_defined_item);
```

WHERE
WR1: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY;
(*

Attribute definitions:

SELF\group.name: the name of the **class_of_involvement**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_involvement** shall be given as specified in the external source.

5.2.3.48 externally_defined_class_of_material_assembly_constraint

An **externally_defined_class_of_material_assembly_constraint** is a type of **class_of_material_assembly_constraint** that is defined by reference to an external source.

EXPRESS specification:

*)
ENTITY externally_defined_class_of_material_assembly_constraint
SUBTYPE OF (class_of_material_assembly_constraint,
externally_defined_item);
WHERE
WR1: SELF\product_category_relationship.name =
SELF\externally_defined_item.item_id;
END_ENTITY;
(*

Attribute definitions:

SELF\product_category_relationship.name: the name of the **class_of_material_assembly_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_material_assembly_constraint** shall be given as specified in the external source.

5.2.3.49 externally_defined_class_of_material_connection_constraint

An **externally_defined_class_of_material_connection_constraint** is a type of **class_of_material_connection_constraint** that is defined by reference to an external source.

EXPRESS specification:

*)
ENTITY externally_defined_class_of_material_connection_constraint
SUBTYPE OF (class_of_material_connection_constraint,
externally_defined_item);
WHERE
WR1: SELF\product_category_relationship.name =
SELF\externally_defined_item.item_id;
END_ENTITY;
(*

Attribute definitions:

SELF\product_category.relationship.name: the name of the **class_of_material_connection_constraint**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_material_connection_constraint** shall be given as specified in the external source.

5.2.3.50 externally_defined_class_of_material

An **external_class_of_material** is a type of **class_of_material** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_material
  SUBTYPE OF (class_of_material, externally_defined_item);
WHERE
  WR1: SELF\product_category.name =
    SELF\externally_defined_item.item_id;
END_ENTITY;
(*
```

Attribute definitions:

SELF\product_category.name: the name of the **class_of_material**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_material** shall be given as specified in the external source.

5.2.3.51 externally_defined_class_of_property

An **external_class_of_property** is a type of **class_of_property** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_class_of_property
  SUBTYPE OF (class_of_property, externally_defined_item);
WHERE
  WR1: SELF\group.name =
    SELF\externally_defined_item.item_id;
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group.name: the name of the **class_of_property**, as defined in the external source.

Formal propositions:

WR1: the name of the **class_of_property** shall be given as specified in the external source.

5.2.3.52 externally_defined_classification_of_class_of_annotation_element

An **externally_defined_classification_of_class_of_annotation_element** is a type of **classification_of_class_of_annotation_element** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_classification_of_class_of_annotation_element
  SUBTYPE OF (classification_of_class_of_annotation_element,
               externally_defined_item);
WHERE
  WR1: SELF\group_relationship.name =
        SELF\externally_defined_item.item_id;
END_ENTITY;
(*
```

Attribute definitions:

SELF\group_relationship.name: the name of the **classification_of_class_of_annotation_element**, as defined in the external source.

Formal propositions:

WR1: the name of the **classification_of_class_of_annotation_element** shall be given as specified in the external source.

5.2.3.53 externally_defined_classification_of_class_of_facility

An **externally_defined_classification_of_class_of_facility** is a type of **classification_of_class_of_facility** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_classification_of_class_of_facility
  SUBTYPE OF (classification_of_class_of_facility,
               externally_defined_item);
WHERE
  WR1: SELF\product_category_relationship.name =
        SELF\externally_defined_item.item_id;
END_ENTITY;
(*)
```

Attribute definitions:

SELF\product_category_relationship.name: the name of the **classification_of_class_of_facility**, as defined in the external source.

Formal propositions:

WR1: the name of the **classification_of_class_of_facility** shall be given as specified in the external source.

5.2.3.54 externally_defined_classification_of_class_of_material

An **externally_defined_classification_of_class_of_material** is a type of **classification_of_class_of_material** that is defined by reference to an external source.

EXPRESS specification:

```
*)  
ENTITY externally_defined_classification_of_class_of_material  
  SUBTYPE OF (classification_of_class_of_material,  
              externally_defined_item);  
WHERE  
  WR1: SELF\product_category_relationship.name =  
        SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\product_category_relationship.name: the name of the **classification_of_class_of_material**, as defined in the external source.

Formal propositions:

WR1: the name of the **classification_of_class_of_material** shall be given as specified in the external source.

5.2.3.55 externally_defined_facility_or_material

An **externally_defined_facility_or_material** is a type of **product_definition** that is defined in an external source. An **externally_defined_facility_or_material** represents a facility or material object that is described by reference to an external catalogue or library.

EXPRESS specification:

```
*)  
ENTITY externally_defined_material_or_facility  
  SUBTYPE OF (product_definition,  
              externally_defined_item);  
WHERE  
  WR1: SELF\product_definition.frame_of_reference.name IN  
        ['physical definition', 'physical occurrence',  
         'functional definition', 'functional occurrence'];  
  WR2: SELF\product_definition.id = SELF\externally_defined_item.item_id;  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\product_definition.id: the name of the **externally_defined_facility_or_material**, as defined in the external source.

Formal propositions:

WR1: An **externally_defined_facility_or_material** is a facility or a material.

WR2: the name of the **externally_defined_facility_or_material** shall be given as specified in the external source.

5.2.3.56 externally_defined_involvement_in_activity_class_constraint

An **external_involvement_in_activity_class_constraint** is a type of **involvement_in_activity_class_constraint** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_involvement_in_activity_class_constraint
  SUBTYPE OF (involvement_in_activity_class_constraint,
              externally_defined_item);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF\group_relationship.relating_group);
  WR2: 'PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_CLASS_OF_ININVOLVEMENT' IN
    TYPEOF (SELF\group_relationship.related_group);
  WR3: SELF\group_relationship.name =
    SELF\externally_defined_item.item_id;
END_ENTITY;
(*
```

Attribute definitions:

SELF\group_relationship.name: the name of the **involvement_in_activity_class_constraint**, as defined in the external source.

Formal propositions:

WR1: The **relating_group** of a **standard_involvement_in_activity_class_constraint** shall be a **standard_class_of_activity**.

WR2: The **related_group** of a **standard_involvement_in_activity_class_constraint** shall be a **standard_class_of_involvement**.

WR3: The name of the **involvement_in_activity_class_constraint** shall be given as specified in the external source.

5.2.3.57 externally_defined_recognized_provision_of_service_according_to_class

An **externally_defined_recognized_provision_of_service_according_to_class** is a type of **recognized_provision_of_service** that is defined by reference to an external source.

EXPRESS specification:

```
* )
ENTITY externally_defined_recognized_provision_of_service_according_to_class
  SUBTYPE OF (recognized_provision_of_service_according_to_class,
              externally_defined_item);
WHERE
```

```

WR1: SELF\product_category_relationship.name =
      SELF\externally_defined_item.item_id;
END_ENTITY;
(*

```

Attribute definitions:

SELF\product_category_relationship.name: the name of the **recognized_provision_of_service_according_to_class**, as defined in the external source.

Formal propositions:

WR1: the name of the **recognized_provision_of_service_according_to_class** shall be given as specified in the external source.

5.2.3.58 externally_defined_representation_item

An **externally_defined_representation_item** is a type of **representation_item** that is defined in an external source.

EXPRESS specification:

```

*)  

ENTITY externally_defined_representation_item  

  SUBTYPE OF (representation_item, externally_defined_item);  

WHERE  

  WR1: SIZEOF (QUERY (t <* TYPEOF (SELF) |  

    NOT (  

      (t LIKE '*.REPRESENTATION_ITEM') OR  

      (t LIKE '*.EXTERNALLY_DEFINED_ITEM') OR  

      (t LIKE '*.EXTERNALLY_DEFINED_REPRESENTATION_ITEM')  

    ))) = 0;  

END_ENTITY;
(*

```

Formal propositions:

WR1: An **externally_defined_representation_item** shall not be combined with any other types in its instantiation.

5.2.3.59 facility_port

A **facility_port** is a type of **product_definition** that enables a flow of energy, load, process material or signal to or from another facility. This entity type satisfies the application specific information requirements stated in clause 4.2.68 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY facility_port  

  SUBTYPE OF (product_definition);  

WHERE  

  WR1: SIZEOF (QUERY (pdr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  

    'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION') |  

    'PLANT_FUNCTIONAL_DATA.POSSESSION_OF_FACILITY_PORT' IN

```

```
    TYPEOF (pdr)
    )) >= 1;
WR2: SELF\product_definition.frame_of_reference.name IN
    [ 'functional definition', 'functional occurrence' ];
END_ENTITY;
(*
```

Formal propositions:

WR1: A **facility_port** shall be the **related_product_definition** in at least one **possession_of_facility_port**.

WR2: A **facility_port** shall be a facility

Informal propositions:

IP1: If the **description** of the **facility_port** has the value ‘actual’, then the **facility_port** exists or has existed.

IP2: If the **description** of the **facility_port** has the value ‘intended’, then the **facility_port** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition** entity data type.

5.2.3.60 information_content_representation

An **information_content_representation** is a type of **representation** that consists of textual and numeric items, or references to such items. An **information_content_representation** represents information content, as defined in clause 4.2.98 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY information_content_representation  
  SUBTYPE OF (representation);  
WHERE  
  WR1: SIZEOF (QUERY (item <* SELF.items |  
    NOT (SIZEOF (TYPEOF (item *  
      [ 'PLANT_FUNCTIONAL_DATA.DESCRIPTIVE_REPRESENTATION_ITEM',  
      'PLANT_FUNCTIONAL_DATA.MEASURE_REPRESENTATION_ITEM',  
      'PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_NUMERIC_OPERATOR',  
      'PLANT_FUNCTIONAL_DATA.' +  
      'EXTERNALLY_DEFINED_REPRESENTATION_ITEM' ]  
    )) >= 1  
    ))) = 0;  
  WR2: SELF.context_of_items.context_type = 'information content';  
END_ENTITY;  
(*
```

Formal propositions:

WR1: Each of the **items** of an **information_content_representation** shall be a **descriptive_representation_item**, a **measure_representation_item**, a **plant_functional_numeric_operator**, or an **externally-defined_representation_item**.

WR2: The **context_type** of the **representation_context** of an **information_content_representation** shall be ‘information content’.

Informal propositions:

IP1: Each **externally_defined_representation** that is an item in an **information_content_representation** shall provide a reference to an external source of textual or numeric information.

5.2.3.61 inheritance_effectivity

An **inheritance_effectivity** is a type of **product_definition_effectivity** that identifies an inheritance between associations. This entity type satisfies the application specific information requirements stated in clause 4.2.99 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY inheritance_effectivity  
  SUBTYPE OF (product_definition_effectivity);  
WHERE  
  WR1: SELF\product_definition_effectivity.usage.  
    relating_product_definition.frame_of_reference.name IN  
    ['functional definition', 'functional occurrence',  
     'physical definition', 'physical occurrence'];  
  WR2: SELF\product_definition_effectivity.usage.  
    related_product_definition.frame_of_reference.name IN  
    ['functional definition', 'functional occurrence',  
     'physical definition', 'physical occurrence'];  
  WR3: SIZEOF (TYPEOF (SELF.usage) *  
    ['PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_VERSION',  
     'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_ALTERNATIVE',  
     'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_DERIVATION']) = 1;  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **relating_product_definition** of the **product_definition_relationship** to which the **inheritance_effectivity** applies shall be a facility or a material.

WR2: The **related_product_definition** of the **product_definition_relationship** to which the **inheritance_effectivity** applies shall be a facility or a material.

WR3: The **product_definition_relationship** to which the **inheritance_effectivity** applies shall be a **product_definition_version**, **product_definition_alternative**, or **product_definition_derivation**.

5.2.3.62 involvement_in_activity_class_constraint_group

An **involvement_in_activity_class_constraint_group** is a type of **involvement_in_activity_class_constraint** and **group**, that identifies an **involvement_in_activity_class_constraint** as the **assigned_group** of a **plant_functional_involvement_of_activity_in_activity_class_constraint_group**. This entity type participates in satisfying the requirement stated in 4.2.152.

EXPRESS specification:

```
* )
ENTITY involvement_in_activity_class_constraint_group
  SUBTYPE OF (involvement_in_activity_class_constraint, group);
WHERE
  WR1: SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
                        'PLANT_FUNCTIONAL_ININVOLVEMENT_OF' +
                        'OBJECT_IN_ACTIVITY_CLASS_CONSTRAINT' +
                        'ASSIGNMENT.ASSIGNED_GROUP')) >= 1;
END_ENTITY;
(*
```

Formal propositions:

WR1: Each **involvement_in_activity_constraint_group** shall be the **assigned_group** in at least one **plant_functional_involvement_of_object_in_activity_class_constraint_assignment**.

5.2.3.63 involvement_in_activity_class_constraint

An **involvement_in_activity_class_constraint** is a type of **group_relationship** that associates a **class_of_activity** and a **class_of_involvement**, and indicates that an involvement that is a member of the **class_of_involvement** is valid for an activity that is a member of the **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.151 of this part of ISO 10303.

An **involvement_in_activity_class_constraint** many be a **An standard_involvement_in_activity_class_constraint** or an **externally_defined_involvement_in_activity_class_constraint**.

EXPRESS specification:

```
* )
ENTITY involvement_in_activity_class_constraint
  SUBTYPE OF (group_relationship);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF.relating_group);
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ININVOLVEMENT' IN
    TYPEOF (SELF.related_group);
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **relating_group** of an **involvement_in_activity_class_constraint** shall be a **class_of_activity**.

WR2: The **related_group** of an **involvement_in_activity_class_constraint** shall be a **class_of_involvement**.

5.2.3.64 orientation_of_material

An **orientation_of_material** is a type of **shape_aspect** and **shape_aspect_relationship** that describes the orientation of one material with respect to another. This entity type satisfies the application specific information requirements stated in clause 4.2.116 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY orientation_of_material  

SUBTYPE OF (shape_aspect, shape_aspect_relationship);  

END_ENTITY;  

(*

```

5.2.3.65 orientation_of_resource_for_facility

An **orientation_of_resource_for_facility** is a type of **shape_aspect** and **shape_aspect_relationship** that describes the orientation of one facility with respect to another. This entity type satisfies the application specific information requirements stated in clause 4.2.117 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY orientation_of_resource_for_facility  

SUBTYPE OF (shape_aspect, shape_aspect_relationship);  

END_ENTITY;  

(*

```

5.2.3.66 page_connector

A **page_connector** is a type of **annotation_occurrence**. This entity type satisfies the application specific information requirements stated in clause 4.2.121 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY page_connector  

SUBTYPE OF (annotation_occurrence);  

END_ENTITY;  

(*

```

5.2.3.67 phase_of_material

A **phase_of_material** is a type of **class_of_material** that defines the solid, liquid, or gaseous phase of a material. This entity type satisfies the application specific information requirements stated in clause 4.2.123 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY phase_of_material  

SUBTYPE OF (class_of_material);  

END_ENTITY;  

(*

```

5.2.3.68 placed_effectivity

A **placed_effectivity** is a type of **effectivity** and **characterized_object** that is used to identify an **effectivity** that is characterized by the **point** in space at which that **effectivity** applies.

EXPRESS specification:

```

*)  

ENTITY placed_effectivity  

  SUBTYPE OF (effectivity, characterized_object);  

WHERE  

  WR1: SIZEOF (USEDIN (SELF , 'PLANT_FUNCTIONAL_DATA.' +  

                        'PROPERTY_DEFINITION.DEFINITION')) = 1;  

  WR2: SIZEOF (QUERY (pd <* USEDIN (SELF , 'PLANT_FUNCTIONAL_DATA.' +  

                        'PROPERTY_DEFINITION.' +  

                        'DEFINITION') |  

                        NOT (SIZEOF (USEDIN (pd, 'PLANT_FUNCTIONAL_DATA.' +  

                                  'PROPERTY_DEFINITION_REPRESENTATION.' +  

                                  'DEFINITION')) = 1  

                    ))) = 0;  

  WR3: SIZEOF (QUERY (pd <* USEDIN (SELF , 'PLANT_FUNCTIONAL_DATA.' +  

                        'PROPERTY_DEFINITION.' +  

                        'DEFINITION') |  

                        NOT (  

                          SIZEOF (QUERY (pdr <* USEDIN (SELF , 'PLANT_FUNCTIONAL_DATA.' +  

                                    'PROPERTY_DEFINITION.' +  

                                    'REPRESENTATION.DEFINITION')) |  

                          NOT (  

                            (SIZEOF (pdr.used_representation.items = 1)) AND  

                            ('PLANT_FUNCTIONAL_DATA.POINT' IN  

                             TYPEOF (pdr.used_representation.items[1]))  

                          ))) = 0  

                    ))) = 0;  

END_ENTITY;
(*

```

Formal propositions:

WR1: Each **placed_effectivity** shall be related to exactly one **property_definition**.

WR2: Each **property_definition** that is related to a **placed_effectivity** shall be related to exactly one **property_definition_representation**.

WR3: Each **representation** that is related, through **property_definition_representation** and **property_definition**, to a **placed_effectivity** shall have exactly one item that is a **point**.

5.2.3.69 plant_functional_action_identification_context_assignment

A **plant_functional_action_identification_context_assignment** is a type of **action_assignment** that associates an **action** with one or more instances of **external_source**, such that the **action** then provides a valid context for an external identification.

EXPRESS specification:

```

*)  

ENTITY plant_functional_action_identification_context_assignment  

  SUBTYPE OF (action_assignment);  

  items: SET [1:?] OF identification_context_item;

```

```

WHERE
WR1: SIZEOF (QUERY (item <* SELF.items |
    NOT (SIZEOF (USEDIN (item, 'PLANT_FUNCTIONAL_DATA.' +
        'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1
    ))) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **external_source** instances for which the assigned **action** provides a valid context for identification.

Formal propositions:

WR1: Every **external_source** that is an item in a **plant_functional_action_identification_context_assignment** shall be the source for at least one **external_identification**.

5.2.3.70 plant_functional_activity_input_information_content_class_constraint_assignment

A **plant_functional_activity_input_information_content_class_constraint_assignment** is a type of **group_assignment** that associates a set of one or more **plant_functional_class_of_object_description_constraint_assignment** to a **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.163 of this part of ISO 10303, in the case where the purpose of the input is a class of activity.

EXPRESS specification:

```

*) 
ENTITY plant_functional_activity_input_information_content_class_constraint_assignment
    SUBTYPE OF (group_assignment);
    items : SET [1:?] OF input_output_information_content_description_item;
WHERE
    WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
        TYPEOF (SELF\group_assignment.assigned_group);
END_ENTITY;
(*

```

Attribute definitions:

items: The set of **plant_functional_class_of_object_description_constraint_assignment**s that are associated with a **class_of_activity**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_activity_input_information_content_class_constraint_assignment** shall be a **class_of_activity**.

5.2.3.71 plant_functional_activity_input_information_content_constraint_assignment

A **plant_functional_activity_input_information_content_constraint_assignment** is a type of **action_assignment** that associates a set of one or more **plant_functional_class_of_object_description_constraint_assignment**s with a **constraint**.

aint_assignment to an **action**. This entity type satisfies the application specific information requirements stated in clause 4.2.163 of this part of ISO 10303, in the case where the purpose of the input is a specific activity.

EXPRESS specification:

```
* )
ENTITY plant_functional_activity_input_information_content_constraint_assignment
  SUBTYPE OF (action_assignment);
  items : SET [1:?] OF input_output_information_content_description_item;
END_ENTITY;
(*
```

Attribute definitions:

items: The set of **plant_functional_class_of_object_description_constraint_assignment**s that are associated with an **action**.

5.2.3.72 plant_functional_activity_input_property_class_constraint_assignment

A **plant_functional_activity_input_property_class_constraint_assignment** is a type of **group_assignment** that associates a set of one or more **plant_functional_recognized_possession_of_property_assignment** to a **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.164 of this part of ISO 10303, in the case where the purpose of the input is a class of activity.

EXPRESS specification:

```
* )
ENTITY plant_functional_activity_input_property_class_constraint_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF input_output_property_possession_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF\group_assignment.assigned_group);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **plant_functional_recognized_possession_of_property_assignments** that are associated with a **class_of_activity**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_activity_input_property_class_constraint_assignment** shall be a **class_of_activity**.

5.2.3.73 plant_functional_activity_input_property_constraint_assignment

A **plant_functional_activity_input_property_constraint_assignment** is a type of **action_assignment** that associates a set of one or more **plant_functional_recognized_possession_of_property_assignment** to an **action**. This entity type satisfies the application specific information requirements stated in clause 4.2.164 of this part of ISO 10303, in the case where the purpose of the input is a specific activity.

EXPRESS specification:

```

*)  

ENTITY plant_functional_activity_input_property_constraint_assignment  

  SUBTYPE OF (action_assignment);  

  items : SET [1:?] OF input_output_property_possession_item;  

END_ENTITY;  

(*

```

Attribute definitions:

items: The set of **plant_functional_recognized_possession_of_property_assignments** that are associated with an **action**.

5.2.3.74 plant_functional_activity_output_information_content_class_constraint_assignment

A **plant_functional_activity_output_information_content_class_constraint_assignment** is a type of **group_assignment** that associates a set of one or more **plant_functional_class_of_object_description_constraint_assignment** to a **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.165 of this part of ISO 10303, in the case where the purpose of the output is a class of activity.

EXPRESS specification:

```

*)  

ENTITY plant_functional_activity_output_information_content_class_constraint_assignment  

  SUBTYPE OF (group_assignment);  

  items : SET [1:?] OF input_output_information_content_description_item;  

WHERE  

  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN  

    TYPEOF (SELF\group_assignment.assigned_group);  

END_ENTITY;  

(*

```

Attribute definitions:

items: The set of **plant_functional_class_of_object_description_constraint_assignment**s that are associated with a **class_of_activity**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_activity_output_information_content_class_constraint_assignment** shall be a **class_of_activity**.

5.2.3.75 plant_functional_activity_output_information_content_constraint_assignment

A **plant_functional_activity_output_information_content_constraint_assignment** is a type of **action_assignment** that associates a set of one or more **plant_functional_class_of_object_description_constraint_assignment** to an **action**. This entity type satisfies the application specific information requirements stated in clause 4.2.165 of this part of ISO 10303, in the case where the purpose of the output is a specific activity.

EXPRESS specification:

```
* )
ENTITY plant_functional_activity_output_information_content_constraint_assignment
  SUBTYPE OF (action_assignment);
  items : SET [1:?] OF input_output_information_content_description_item;
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **plant_functional_class_of_object_description_constraint_assignment**s that are associated with an **action**.

5.2.3.76 plant_functional_activity_output_property_class_constraint_assignment

A **plant_functional_activity_output_property_class_constraint_assignment** is a type of **group_assignment** that associates a set of one or more **plant_functional_recognized_possession_of_property_assignment**s to a **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.166 of this part of ISO 10303, in the case where the purpose of the output is a class of activity.

EXPRESS specification:

```
* )
ENTITY plant_functional_activity_output_property_class_constraint_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF input_output_property_possession_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF\group_assignment.assigned_group);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **plant_functional_recognized_possession_of_property_assignments** that are associated with a **class_of_activity**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_activity_output_property_class_constraint_assignment** shall be a **class_of_activity**.

5.2.3.77 plant_functional_activity_output_property_constraint_assignment

A **plant_functional_activity_output_property_constraint_assignment** is a type of **action_assignment** that associates a set of one or more **plant_functional_recognized_possession_of_property_assignment**s to an **action**. This entity type satisfies the application specific information requirements stated in clause 4.2.166 of this part of ISO 10303, in the case where the purpose of the output is a specific activity.

EXPRESS specification:

```

*)  

ENTITY plant_functional_activity_output_property_constraint_assignment  

  SUBTYPE OF (action_assignment);  

  items : SET [1:?] OF input_output_property_possession_item;  

END_ENTITY;  

(*

```

Attribute definitions:

items: The set of **plant_functional_recognized_possession_of_property_assignments** that are associated with an **action**.

5.2.3.78 plant_functional_activity_performer_assignment

A **plant_functional_activity_performer_assignment** is a type of **action_assignment** that relates an Activity (see 4.2.7) to a **person**, **organization**, or **product_definition**, where the involvement of the object is as the Performer (see annex M, instance 537).

EXPRESS specification:

```

*)  

ENTITY plant_functional_activity_performer_assignment  

  SUBTYPE OF (action_assignment);  

  items : SET [1:?] OF activity_performer_item;  

WHERE  

  WR1: SIZEOF (QUERY (pd <* QUERY (item <* SELF.items |  

    ('PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF (item))) |  

    NOT (pd\product_definition.frame_of_reference.name IN  

      ['functional definition','functional occurrence',  

       'physical definition','physical occurrence'])  

    ))) = 0;  

END_ENTITY;  

(*

```

Attribute definitions:

items: the set of **person**, **organization**, or **product_definition** instances that are involved in the Activity as Performer.

Formal propositions:

WR1: Each **product_definition** that is assigned by a **plant_functional_activity_performer_assignment** shall be a Facility (see 4.2.89) or a Material (see 4.2.110).

5.2.3.79 plant_functional_approval_assignment

A **plant_functional_approval_assignment** is a type of **approval_assignment** that assigns an **approval** to a set of **product_definition**, **class_of_material**, **class_of_facility**, **action**, **action_method**, or **class_of_activity**. This entity type satisfies the application specific information requirements stated in clause 4.2.16 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY plant_functional_approval_assignment

```

```
SUBTYPE OF (approval_assignment);
  items : SET [1:?] OF approval_item;
WHERE
  WR1: SELF.role.description IN ['actual', 'intended'];
END_ENTITY;
(*)
```

Attribute definitions:

items: the set of items that are assigned to an **approval**.

Formal propositions:

WR1: Every **plant_functional_approval_assignment** shall be described as either ‘actual’ or ‘intended’.

5.2.3.80 plant_functional_approval_effectivity_assignment

A **plant_functional_approval_effectivity_assignment** is a type of **effectivity_assignment** that assigns set of one or more **plant_functional_approval_assignment** to a **process_or_process_relationship_effectivity**. This assignment defines an effectivity for the approval. This entity type satisfies the application specific information requirements stated in clause 4.2.103 of this part of ISO 10303, in the case where activity is check (approval).

EXPRESS specification:

```
*)
ENTITY plant_functional_approval_effectivity_assignment
  SUBTYPE OF (effectivity_assignment);
  items : SET [1:?] OF approval_effectivity_item;
WHERE
  WR1: ('PLANT_FUNCTIONAL_DATA.' +
         'PROCESS_OR_PROCESS_RELATIONSHIP_EFFECTIVITY') IN
    TYPEOF (SELF.assigned_effectivity);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **plant_functional_approval_assignment** that is assigned to a **process_or_process_relationship_effectivity**.

Formal propositions:

WR1: The **assigned_effectivity** of a **plant_functional_approval_effectivity_assignment** shall be a **process_or_process_relationship_effectivity**.

5.2.3.81 plant_functional_assessed_object_activity_assignment

A **plant_functional_assessed_object_activity_assignment** is a type of **action_assignment** that relates an Assess (see annex M, instance 1) Activity to any object, where the involvement of the object is as the Assessed_object (see annex M, instance 530).

EXPRESS specification:

```
*)
ENTITY plant_functional_assessed_object_activity_assignment
```

```

SUBTYPE OF (action_assignment);
  items : SET [1:?] OF approval_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
                                         'PLANT_FUNCTIONAL_DATA.' +
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                          TYPEOF (act\group_assignment.assigned_group)) AND
                                         (act\group_assignment.assigned_group.name = 'Assess'))
                    )) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
                                     'PLANT_FUNCTIONAL_DATA.' +
                                     'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                                     ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                      TYPEOF (acm\group_assignment.assigned_group)) AND
                                     (acm\group_assignment.assigned_group.name = 'Assess'))
                    )) = 1;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **approval_items** that are involved in the Assess Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_assessed_object_activity_assignment** shall be classified as an ‘Assess’ Activity, or the **action_method** of the action that is assigned by a **plant_functional_assessed_object_activity_assignment** shall be classified as an ‘Assess’ Activity.

5.2.3.82 plant_functional_assessment_purpose_activity_assignment

A **plant_functional_assessment_purpose_activity_assignment** is a type of **action_assignment** that relates an Assess (see annex M, instance 1) Activity to an **action**, **action_method**, or **class_of_activity**, where the involvement of the object is as the Assessment_purpose (see annex M, instance 531).

EXPRESS specification:

```

*)
ENTITY plant_functional_assessment_purpose_activity_assignment
SUBTYPE OF (action_assignment);
  items : SET [1:?] OF assessment_purpose_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
                                         'PLANT_FUNCTIONAL_DATA.' +
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                          TYPEOF (act\group_assignment.assigned_group)) AND
                                         (act\group_assignment.assigned_group.name = 'Assess'))
                    )) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
                                     'PLANT_FUNCTIONAL_DATA.' +

```

```

    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS' ) |
( 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
  TYPEOF (acm\group_assignment.assigned_group)) AND
  (acm\group_assignment.assigned_group.name = 'Assess')
) ) = 1;
END_ENTITY;

```

(*

Attribute definitions:

items: the set of **action**, **action_method**, or **class_of_activity** instances that are involved in the Assess Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_assessment_purpose_activity_assignment** shall be classified as an ‘Assess’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_assessment_purpose_activity_assignment** shall be classified as an ‘Assess’ Activity.

5.2.3.83 plant_functional_assessment_result_activity_assignment

A **plant_functional_assessment_result_activity_assignment** is a type of **action_assignment** that relates an Assess Activity to an **effectivity**, where the involvement of the object is as the **Assessment_result** (see annex M, instance 532).

EXPRESS specification:

```

*) 
ENTITY plant_functional_assessment_result_activity_assignment
SUBTYPE OF (action_assignment);
  items : SET [1:?] OF assessment_result_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS' ) |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (act\group_assignment.assigned_group)) AND
      (act\group_assignment.assigned_group.name = 'Assess')
) ) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS' ) |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (acm\group_assignment.assigned_group)) AND
      (acm\group_assignment.assigned_group.name = 'Assess')
) ) = 1;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **effectivity** instances that are involved in the Assess Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_assessment_result_activity_assignment** shall be classified as an ‘Assess’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_assessment_result_activity_assignment** shall be classified as an ‘Assess’ Activity.

5.2.3.84 plant_functional_class_of_activity_assignment

A **plant_functional_class_of_activity_assignment** is a type of **group_assignment** which assigns a set of activities to **class_of_activity** in order to classify them. This entity type satisfies the application specific information requirements stated in clause 4.2.33 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_activity_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF class_of_activity_item;
END_ENTITY;
(*
```

Attribute definitions:

items: the set of activities that are assigned to the **class_of_activity**.

5.2.3.85 plant_functional_class_of_annotation_element_assignment

A **plant_functional_class_of_annotation_element_assignment** is a type of **group_assignment** assigns a set of annotation elements to a **class_of_annotation_element** in order to classify them. This entity type satisfies the application specific information requirements stated in clause 4.2.34 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_annotation_element_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF annotation_element_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT'
    in TYPEOF (SELF.assigned_group);
END_ENTITY;
(*)
```

Attribute definitions:

items: the set of annotation elements that are assigned to the **class_of_annotation_element**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_class_of_annotation_element_assignment** shall be a **class_of_annotation_element**.

5.2.3.86 plant_functional_class_of_annotation_element_library_assignment

A **plant_functional_class_of_annotation_element_library_assignment** assigns a set of **class_of_annotation_element** to a library of such items. This entity type satisfies the application specific information requirements stated in clause 4.2.46 of this part of ISO 10303, in the case where the collection is used as library.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_annotation_element_library_assignment
  SUBTYPE OF (library_assignment);
  items : SET [1:?] OF class_of_annotation_element_library_item;
WHERE
  WR1: SELF.frame_of_reference.library_reference =
    'class of annotation element library';
END_ENTITY;
(*
```

Attribute definitions:

items: The set of one or more **class_of_annotation_elements** which are assigned to a library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘class of facility library’.

5.2.3.87 plant_functional_class_of_facility_library_assignment

A **plant_functional_class_of_facility_library_assignment** assigns a set of **class_of_facility** to a library of such items. This entity type satisfies the application specific information requirements stated in clause 4.2.54 of this part of ISO 10303, in the case where the collection is used as library.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_facility_library_assignment
  SUBTYPE OF (library_assignment);
  items : SET [1:?] OF class_of_facility_library_item;
WHERE
  WR1: SELF.frame_of_reference.library_reference =
    'class of facility library';
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of one or more **class_of_facilities** which are assigned to a library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘class of facility library’.

5.2.3.88 plant_functional_class_of_information_content_assignment

A **plant_functional_class_of_information_content_assignment** is an association between a **representation_context** and a **class_of_information_content**, that indicates the **representation_context** is a mem-

ber of the class. Each **representation** that shares such a **representation_context** is a representation of information content. This is indicated by specifying the **context_type** of the **representation_context** to be ‘information content’. This entity type satisfies the application specific information requirements stated in clause 4.2.39 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_class_of_information_content_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF information_content_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT'  
    IN TYPEOF (SELF.assigned_group);  
  WR2: SIZEOF (QUERY (i <* SELF.items |  
    NOT (i\representation_context.context_type =  
      'information content')  
  )) = 0;  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **representation_contexts** that are assigned to a **group** to classify them as belonging to a **class_of_information_content**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_class_of_information_content_assignment** shall be a **class_of_information_content**.

WR2: Each **representation_content** in the **items** set shall have the **context_type** ‘information content’.

5.2.3.89 plant_functional_class_of_information_content_library_assignment

A **plant_functional_class_of_information_content_library_assignment** is a type of **library_assignment** assigns a set of **class_of_information_content** to a library of such items. This entity type satisfies the application specific information requirements stated in clause 4.2.49 of this part of ISO 10303, the case where the collection is a library.

EXPRESS specification:

```
*)  
ENTITY plant_functional_class_of_information_content_library_assignment  
  SUBTYPE OF (library_assignment);  
  items : SET [1:?] OF class_of_information_content_library_item;  
WHERE  
  WR1: SELF.frame_of_reference.library_reference =  
    'class of information content library';  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of one or more **class_of_information_contents** which are assigned to a library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘class of information content library’.

5.2.3.90 plant_functional_class_of_information_held_by_information_carrier_assignment

A **plant_functional_class_of_information_held_by_information_carrier_assignment** is an association between a **product_definition** and a **class_of_information_content**, that indicates the **product_definition** is a member of the class. Each such **product_definition** is a facility or a material that is an information carrier. This assignment classifies the information carrier by the type of information content that it carries or may carry. This entity type satisfies the application specific information requirements stated in clause 4.2.28 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_class_of_information_held_by_information_carrier_assignment  
  SUBTYPE of (group_assignment);  
  items : SET [1:?] OF information_carrier_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT'  
    IN TYPEOF (SELF.assigned_group);  
  WR2: SIZEOF (QUERY (i <* SELF.items |  
    NOT ((i\product_definition.  
      frame_of_reference\application_context_element.name IN  
      ['functional definition', 'functional occurrence',  
      'physical definition', 'physical occurrence']) AND  
      (i\product_definition.  
        frame_of_reference\application_context_element.  
        frame_of_reference[1].name = 'information holder')  
    ))) = 0;  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **product_definitions** that are assigned to a **group** to classify them as belonging to a **class_of_information_content**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_class_of_information_held_by_information_carrier_assignment** shall be a **class_of_information_content**.

WR2: Each **product_definition** in the **items** set shall be a facility or a material that plays the role of an information carrier.

5.2.3.91 plant_functional_class_of_involvement_assignment

A **plant_functional_class_of_involvement_assignment** is a type of **group_assignment** which assigns a set of involvements to **class_of_involvement** in order to classify them. The following involvements may

be classified: **process_product_association**, **process_property_association**, **plant_functional_organization_assignment**, and **plant_functional_person_assignment**. This entity type satisfies the application specific information requirements stated in clause 4.2.40 of this part of ISO 10303.

EXPRESS specification:

```

*) 
ENTITY plant_functional_class_of_involvement_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF class_of_involvement_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ININVOLVEMENT' IN
    TYPEOF (SELF.assigned_group);
  WR2: SIZEOF (QUERY (pfoa <* QUERY (item <* SELF.items |
    'PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_ORGANIZATION_ASSIGNMENT'
    IN TYPEOF (item)) |
    NOT (
      SIZEOF (QUERY (org_item <* pfoa.items |
        NOT ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN TYPEOF (org_item))
      )) = 0 )
    )) = 0;
  WR3: SIZEOF (QUERY (pfpa <* QUERY (item <* SELF.items |
    'PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_PERSON_ASSIGNMENT'
    IN TYPEOF (item)) |
    NOT (
      SIZEOF (QUERY (per_item <* pfpa.items |
        NOT ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN TYPEOF (per_item))
      )) = 0 )
    )) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of involvements that are assigned to the **class_of_involvement**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_class_of_involvement_assignment** shall be a **class_of_involvement**.

WR2: Each **plant_functional_organization_assignment** that is classed as an involvement shall be the assignment of an **organization** to an **action_resource**.

WR2: Each **plant_functional_person_assignment** that is classed as an involvement shall be the assignment of a **person** to an **action_resource**.

5.2.3.92 plant_functional_class_of_material_library_assignment

A **plant_functional_class_of_material_library_assignment** assigns a set of **class_of_material** to a library of such items. This entity type satisfies the application specific information requirements stated in clause 4.2.55 of this part of ISO 10303, in the case where the collection is used as library.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_material_library_assignment
  SUBTYPE OF (library_assignment);
  items : SET [1:?] OF class_of_material_library_item;
WHERE
  WR1: SELF.frame_of_reference.library_reference =
    'class of material library';
END_ENTITY;
(*
```

Attribute definitions:

items: The set of one or more **class_of_materials** which are assigned to a library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘class of material library’.

5.2.3.93 plant_functional_class_of_object_description_constraint_assignment

A **plant_functional_class_of_object_description_constraint_assignment** is a type of **group_assignment** that assigns a **class_of_information_content** to a **class_of_facility**, **class_of_material** or a **class_of_activity**, and defines a constraint on the use of **information_content** for description. This entity type satisfies the application specific information requirements stated in clause 4.2.150 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_class_of_object_description_constraint_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF described_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT'
    IN TYPEOF (SELF.assigned_group);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **class_of_material**, **class_of_facility**, or **class_of_activity** that are assigned to a **group** as describable by a **class_of_information_content**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_class_of_object_description_constraint_assignment** shall be a **class_of_information_content**.

5.2.3.94 plant_functional_class_of_property_library_assignment

A **plant_functional_class_of_property_library_assignment** is a type of **library_assignment**, that assigns a set of one or more **class_of_property** to a library of such items.

This entity type satisfies the application specific information requirements stated in clause 4.2.51 of this part of ISO 10303, in the case where the collection is used as library.

EXPRESS specification:

```

*)  

ENTITY plant_functional_class_of_property_library_assignment  

  SUBTYPE OF (library_assignment);  

  items : SET [1:?] OF class_of_property_library_item;  

WHERE  

  WR1: SELF.frame_of_reference.library_reference =  

    'class of property library';  

END_ENTITY;  

(*

```

Attribute definitions:

items: The set of one or more **class_of_property**s which are assigned to a library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘class of property library’.

5.2.3.95 plant_functional_context_for_hierarchy_action_assignment

A **plant_functional_context_for_hierarchy_action_assignment** is a type of **action_assignment** that assigns an **action** to a set of one or more **product_definition**, to identify the **action** as providing context for the hierarchy of which the **product_definition** is the root. This entity type satisfies the application specific information requirements stated in clause 4.2.183 and clause 4.2.184 of this part of ISO 10303, in the case where the context for the hierarchy is a class of activity.

EXPRESS specification:

```

*)  

ENTITY plant_functional_context_for_hierarchy_action_assignment  

  SUBTYPE OF (action_assignment);  

  items : SET [1:?] OF hierarchy_context_item;  

WHERE  

  WR1: SIZEOF (QUERY (item <* SELF.items |  

    NOT (  

      SIZEOF (QUERY (pdr <* USEDIN (item,  

        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +  

        'RELATING_PRODUCT_DEFINITION') |  

        'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN  

        TYPEOF (pdr)  

      )) >= 1  

    ))) = 0;  

END_ENTITY;  

(*

```

Attribute definitions:

items: The set of **product_definition** which is assigned to an **action**.

Formal propositions:

WR1: Each of the **items** of a **plant_functional_context_for_hierarchy_action_assignment** shall be the **relating_product_definition** of a **specified_higher_usage_occurrence**.

5.2.3.96 plant_functional_context_for_hierarchy_group_assignment

A **plant_functional_context_for_hierarchy_group_assignment** is a type of **group_assignment** that assigns a **class_of_activity** to a set of one or more **product_definition**, to identify the **class_of_activity** as providing context for the hierarchy of which the **product_definition** is the root. This entity type satisfies the application specific information requirements stated in clause 4.2.183 and clause 4.2.184 of this part of ISO 10303, in the case where the context for the hierarchy is a class of activity.

EXPRESS specification:

```
*)  
ENTITY plant_functional_context_for_hierarchy_group_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF hierarchy_context_item;  
WHERE  
  WR1: SIZEOF (QUERY (item <* SELF.items |  
    NOT (  
      SIZEOF (QUERY (pdr <* USEDIN (item,  
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +  
        'RELATING_PRODUCT_DEFINITION') |  
        'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN  
        TYPEOF (pdr)  
      )) >= 1  
    ))) = 0;  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN  
    TYPEOF (SELF\group_assignment.assigned_group);  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **product_definition** which is assigned to a **class_of_activity**.

Formal propositions:

WR1: Each of the **items** of a **plant_functional_context_for_hierarchy_group_assignment** shall be the **relating_product_definition** of a **specified_higher_usage_occurrence**.

WR2: The **assigned_group** of a **plant_functional_context_for_hierarchy_group_assignment** shall be a **class_of_activity**.

5.2.3.97 plant_functional_context_for_hierarchy_organization_assignment

A **plant_functional_context_for_organization_assignment** is a type of **organization_assignment** that assigns an **organization** to a set of one or more **product_definition**, to identify the **organization** as providing context for the hierarchy of which the **product_definition** is the root. This entity type satisfies the application specific information requirements stated in clause 4.2.183 and clause 4.2.184 of this part of ISO 10303, in the case where the context for the hierarchy is a class of activity.

EXPRESS specification:

```
*)  
ENTITY plant_functional_context_for_hierarchy_organization_assignment  
  SUBTYPE OF (organization_assignment);
```

```

items : SET [1:?] OF hierarchy_context_item;
WHERE
  WR1: SIZEOF (QUERY (item <* SELF.items |
    NOT (
      SIZEOF (QUERY (pdr <* USEDIN (item,
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
        'RELATING_PRODUCT_DEFINITION') |
        'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN
        TYPEOF (pdr)
      )) >= 1
    ))) = 0;
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF\organization_assignment.assigned_organization);
END_ENTITY;
(*

```

Attribute definitions:

items: The set of **product_definition** which is assigned to a **class_of_activity**.

Formal propositions:

WR1: Each of the **items** of a **plant_functional_context_for_hierarchy_organization_assignment** shall be the **relating_product_definition** of a **specified_higher_usage_occurrence**.

WR2: The **assigned_organization** of a **plant_functional_context_for_hierarchy_organization_assignment** shall be a **class_of_activity**.

5.2.3.98 plant_functional_data_record_name_assignment

A **plant_functional_data_record_name_assignment** is a type of **name_assignment** which assigns a name to a set of one or more data records.

EXPRESS specification:

```

*)
ENTITY plant_functional_data_record_name_assignment
  SUBTYPE OF (name_assignment);
  items : SET [1:?] OF named_item;
END_ENTITY;
(*

```

Attribute definitions:

items: The set of one or more **named_items** to which a name is assigned.

5.2.3.99 plant_functional_design_reference_activity_assignment

A **plant_functional_design_reference_activity_assignment** is a type of **action_assignment** that relates a Design (see annex M, instance 2 Activity to any object, where the object is referenced by the Design Activity.

EXPRESS specification:

```

*)
ENTITY plant_functional_design_reference_activity_assignment
SUBTYPE OF (action_assignment);
  items : SET [1:?] OF design_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (act\group_assignment.assigned_group)) AND
      (act\group_assignment.assigned_group.name = 'Design'))
  )) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (acm\group_assignment.assigned_group)) AND
      (acm\group_assignment.assigned_group.name = 'Design'))
  )) = 1;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **design_item** instances that is referenced by the Design Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_design_reference_activity_assignment** shall be classified as a ‘Design’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_design_reference_activity_assignment** shall be classified as a ‘Design’ Activity.

5.2.3.100 plant_functional_design_result_activity_assignment

A **plant_functional_design_result_activity_assignment** is a type of **action_assignment** that relates a Design (see annex M, instance 2 Activity to any object, where the object is the result of the Design Activity.

EXPRESS specification:

```

*)
ENTITY plant_functional_design_result_activity_assignment
SUBTYPE OF (action_assignment);
  items : SET [1:?] OF design_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (act\group_assignment.assigned_group)) AND
      (act\group_assignment.assigned_group.name = 'Design'))
  )) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF (acm\group_assignment.assigned_group)) AND
      (acm\group_assignment.assigned_group.name = 'Design'))
  )) = 1;
END_ENTITY;
(*

```

```

    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS' )
  ( 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
    TYPEOF (acm\group_assignment.assigned_group)) AND
    (acm\group_assignment.assigned_group.name = 'Design')
  )) = 1;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **design_item** instances that is the result of the Design Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_design_result_activity_assignment** shall be classified as a ‘Design’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_design_result_activity_assignment** shall be classified as a ‘Design’ Activity.

5.2.3.101 plant_functional_effectivity_assignment

A **plant_functional_effectivity_assignment** is a type of **effectivity_assignment** that defines the beginning or end of an item. This entity type satisfies the application specific information requirements stated in clause 4.2.21 of this part of ISO 10303.

EXPRESS specification:

```

*) 
ENTITY plant_functional_effectivity_assignment
  SUBTYPE OF (effectivity_assignment);
  items : SET [1:?] OF effectivity_item;
WHERE
  WR1: SELF.assigned_effectivity.id IN
    ['beginning', 'end'];
END_ENTITY;
(*

```

Attribute definitions:

items: The set of items that are associated with a beginning or end effectivity.

Formal propositions:

WR1: The **id** of the **assigned_effectivity** shall be one of the values ‘beginning’ or ‘end’, to indicate whether the effectivity defines the initiation of an item or its termination.

5.2.3.102 plant_functional_enumerated_property_in_class_of_property_assignment

An **plant_functional_enumerated_property_in_class_of_property_assignment** is a type of **group_assignment** that associates a set of instances of **property_definition** and **action_property** to a **class_of_property** as being an enumerated instances that are members of the class.

The meaning of this association is defined in clause 4.2.87 of this part of ISO 10303.

EXPRESS specification:

```

*)

```

```

ENTITY plant_functional_enumerated_property_in_class_of_property_assignment
SUBTYPE OF (group_assignment);
  items : SET [1:?] OF class_of_property_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN
    TYPEOF (SELF.assigned_group);
  WR2: SIZEOF (QUERY (prop <* QUERY (item <* SELF.items |
    'PLANT_FUNCTIONAL_DATA.PROPERTY_DEFINITION' IN
    TYPEOF (item)) |
    NOT (
    SIZEOF (USEDIN (prop, 'PLANT_FUNCTIONAL_DATA.' +
    'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) > 0
    ))) = 0;
  WR3: SIZEOF (QUERY (prop <* QUERY (item <* SELF.items |
    'PLANT_FUNCTIONAL_DATA.ACTION_PROPERTY' IN
    TYPEOF (item)) |
    NOT (
    SIZEOF (USEDIN (prop, 'PLANT_FUNCTIONAL_DATA.' +
    'ACTION_DEFINITION_REPRESENTATION.PROPERTY')) > 0
    ))) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: The set of **property_definition** and **action_property** that are members of the **class_of_property**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_enumerated_property_in_class_of_property** shall be a **class_of_property**.

WR2: Each **property_definition** that is enumerated as a member of the **class_of_property** shall have a **representation**.

WR3: Each **action_property** that is enumerated as a member of the **class_of_property** shall have a **representation**.

5.2.3.103 plant_functional_group_identification_context_assignment

A **plant_functional_group_identification_context_assignment** is a type of **action_assignment** that associates a **class_of_activity** with one or more instances of **external_source**, such that the **class_of_activity** then provides a valid context for an external identification.

EXPRESS specification:

```

*)
ENTITY plant_functional_group_identification_context_assignment
SUBTYPE OF (group_assignment);
  items: SET [1:?] OF identification_context_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN
    TYPEOF (SELF.assigned_group);

```

```

WR2: SIZEOF (QUERY (item <* SELF.items |
    NOT (SIZEOF (USEDIN (item, 'PLANT_FUNCTIONAL_DATA.' +
        'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1
    ))) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **external_source** instances for which the assigned **group** provides a valid context for identification.

Formal propositions:

WR1: The **assigned_group** of every **plant_functional_group_identification_context_assignment** shall be a **class_of_activity**.

WR2: Every **external_source** that is an item in a **plant_functional_group_identification_context_assignment** shall be the source for at least one **external_identification**.

5.2.3.104 plant_functional_identification_assignment

A **plant_functional_identification_assignment** is a type of **identification_assignment** that assigns a textual identifier to any **identified_item**.

EXPRESS specification:

```

*)
ENTITY plant_functional_identification_assignment
SUBTYPE OF (identification_assignment);
    item : identified_item;
END_ENTITY;
(*

```

Attribute definitions:

items: the **identified_item** instance to which an identifier is assigned.

5.2.3.105 plant_functional_information_carrier_description_assignment

A **plant_functional_information_carrier_description_assignment** is a type of **document_reference** that assigns a document to a product data item such that the former is descriptive of the latter. A **plant_functional_information_carrier_description_assignment** may be a **plant_functional_information_carrier_definition_assignment** or a **plant_functional_information_carrier_reference_assignment**. This entity type satisfies the application specific information requirements stated in clause 4.2.80 of this part of ISO 10303.

EXPRESS specification:

```

*)
ENTITY plant_functional_information_carrier_description_assignment
SUPERTYPE OF (ONEOF
    (plant_functional_information_carrier_definition_assignment,
     plant_functional_information_carrier_reference_assignment))

```

```
SUBTYPE OF (document_reference);
  items : SET [1:?] OF described_item;
WHERE
  WR1: SIZEOF (USEDIN (SELF\document_reference.assigned_document,
    'PLANT_FUNCTIONAL_SCHEMA.PRODUCT_DEFINITION_'
    'WITH_ASSOCIATED_DOCUMENTS.DOCUMENTATION_IDS')) ) >= 1;
END_ENTITY;
(*
```

Attribute definitions:

items: The set of product data items that are described by a document.

Formal propositions:

WR1: The **assigned_document** of a **plant_functional_information_carrier_description_assignment** shall participate in at least one **product_definition_with_associated_documents**.

5.2.3.106 plant_functional_information_carrier_definition_assignment

A **plant_functional_information_carrier_definition_assignment** is a type of **plant_functional_information_carrier_description_assignment** where the description is definitional in nature. This entity type fulfils the application specific information requirements stated in clause 4.2.73 of this part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY plant_functional_information_carrier_definition_assignment
  SUBTYPE OF (plant_functional_information_carrier_description_assignment);
END_ENTITY;
(*)
```

5.2.3.107 plant_functional_information_carrier_reference_assignment

A **plant_functional_information_carrier_reference_assignment** is a type of **plant_functional_information_carrier_description_assignment** where the description is referential in nature. This entity type fulfils the application specific information requirements stated in clause 4.2.160 of this part of ISO 10303.

EXPRESS specification:

```
*)
ENTITY plant_functional_information_carrier_reference_assignment
  SUBTYPE OF (plant_functional_information_carrier_description_assignment);
END_ENTITY;
(*)
```

5.2.3.108 plant_functional_information_content_description_assignment

A **plant_functional_information_content_description_assignment** is a type of **document_reference** that assigns a document to a product data item such that the former is descriptive of the latter. A **plant_functional_information_content_description_assignment** may be a **plant_functional_information_content_definition_assignment** or a **plant_functional_information_content_reference_assignment**. This

entity type satisfies the application specific information requirements stated in clause 4.2.79 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_information_content_description_assignment  
  SUPERTYPE OF (ONEOF  
    (plant_functional_information_content_definition_assignment,  
     plant_functional_information_content_reference_assignment))  
  SUBTYPE OF (document_reference);  
  items : SET [1:?] OF described_item;  
WHERE  
  WR1: SIZEOF (USEDIN (SELF\document_reference.assigned_document,  
    'PLANT_FUNCTIONAL_SCHEMA.PRODUCT_DEFINITION_' +  
    'WITH_ASSOCIATED_DOCUMENTS.DOCUMENTATION_IDS')) >= 1;  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of product data items that are described by a document.

Formal propositions:

WR1: The **assigned_document** of a **plant_functional_information_content_description_assignment** shall participate in at least one **product_definition_with_associated_documents**.

5.2.3.109 plant_functional_information_content_definition_assignment

A **plant_functional_information_content_definition_assignment** is a type of **plant_functional_information_content_description_assignment** where the description is definitional in nature. This entity type fulfils the application specific information requirements stated in clause 4.2.73 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_information_content_definition_assignment  
  SUBTYPE OF (plant_functional_information_content_description_assignment);  
END_ENTITY;  
(*
```

5.2.3.110 plant_functional_information_content_reference_assignment

A **plant_functional_information_content_reference_assignment** is a type of **plant_functional_information_content_description_assignment** where the description is referential in nature. This entity type fulfils the application specific information requirements stated in clause 4.2.160 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_information_content_reference_assignment  
  SUBTYPE OF (plant_functional_information_content_description_assignment);  
END_ENTITY;  
(*
```

5.2.3.111 plant_functional_inheritance_exclusion_assignment

A **plant_functional_inheritance_exclusion_assignment** is a type of **effectivity_assignment** that excludes a set of one or more items from an **inheritance_effectivity**. This entity type satisfies the application specific information requirements stated in clause 4.2.88 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_inheritance_exclusion_assignment
  SUBTYPE OF (effectivity_assignment);
  items : SET [1:?] OF inherited_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.INHERITANCE_EFFECTIVITY' IN
    TYPEOF (SELF.assigned_effectivity);
END_ENTITY;
(*
```

Attribute definitions:

items: The set of associations that are excluded.

Formal propositions:

WR1: The **assigned_effectivity** of a **plant_functional_inheritance_exclusion_assignment** shall be a **inheritance_effectivity**.

5.2.3.112 plant_functional_inheritance_inclusion_assignment

A **plant_functional_inheritance_inclusion_assignment** is a type of **effectivity_assignment** that includes a set of one or more items from an **inheritance_effectivity**. This entity type satisfies the application specific information requirements stated in clause 4.2.97 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_inheritance_inclusion_assignment
  SUBTYPE OF (effectivity_assignment);
  items : SET [1:?] OF inherited_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.INHERITANCE_EFFECTIVITY' IN
    TYPEOF (SELF.assigned_effectivity);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of associations that are included.

Formal propositions:

WR1: The **assigned_effectivity** of a **plant_functional_inheritance_inclusion_assignment** shall be a **inheritance_effectivity**.

5.2.3.113 plant_functional_involvement_constraint_assignment

A **plant_functional_involvement_constraint_assignment** is a type of **group_assignment** that assigns a set of **class_of_material** or **class_of_facility** to a **class_of_involvement**. This entity type satisfies the application specific information requirements stated in clause 4.2.153 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY plant_functional_involvement_constraint_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF involved_class_item;
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ININVOLVEMENT' IN
    TYPEOF (SELF.assigned_group);
END_ENTITY;
(*
```

Attribute definitions:

items: The set of **class_of_material** or **class_of_facility** that are associated with a **class_of_involvement**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_involvement_constraint_assignment** shall be a **class_of_involvement**.

5.2.3.114 plant_functional_involvement_of_object_in_activity_class_constraint_assignment

A **plant_functional_involvement_of_object_in_activity_class_constraint_assignment** is a type of **group_assignment** that assigns a set of **class_of_material** or **class_of_facility** to a **involvement_in_activity_class_constraint_group**. In conjunction with the **involvement_in_activity_constraint_group** entity type (see 5.2.3.62), this entity type participates in satisfying the requirement stated in 4.2.152.

EXPRESS specification:

```
* )
ENTITY plant_functional_involvement_of_object_in_activity_class_constraint_assignment
  SUBTYPE OF (group_assignment);
  items : SET [1:?] OF involved_class_item;
WHERE
  WR1: ('PLANT_FUNCTIONAL_DATA.' +
    'INVOLVEMENT_IN_ACTIVITY_CLASS_CONSTRAINT_GROUP') IN
    TYPEOF (SELF.assigned_group);
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of **class_of_material** or **class_of_facility** that are assigned to an **involvement_in_activity_class_constraint_group**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_involvement_of_object_in_activity_class_constraint_assignment** shall be an **involvement_in_activity_class_constraint_group**.

5.2.3.115 plant_functional_numeric_operator

A **plant_functional_numeric_operator** is a type of **qualified_representation_item** that allows the qualification of a numeric value. This qualification allows the **representation_item** to specify items that are equal to, greater than, greater than or equal to, less than, less than or equal to, or not equal to, some specified value. This entity type satisfies the application specific information requirements stated in clause 4.2.111 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_numeric_operator  
  SUBTYPE OF (qualified_representation_item);  
WHERE  
  WR1: SIZEOF (SELF.qualifiers) = 1;  
  WR2: 'PLANT_FUNCTIONAL_DATA.TYPE_QUALIFIER' IN  
    TYPEOF (SELF.qualifiers[1]);  
  WR3: SELF.qualifiers[1]\type_qualifier.name IN  
    [ '=' , '>' , '>=' , '<' , '<=' , '<>' ];  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **plant_functional_numeric_operator** shall have one qualifier.

WR2: This qualifier shall be a **type_qualifier**.

WR3: The name of the qualifier shall be “=”, “>”, “>=”, “<”, “<=”, or “<>”.

Attribute value definitions:

Table 29 states the meaning of each of the standard values of the qualifier.

Table 29 – Standard data for plant_functional_numeric_operator qualifiers

=	equal to
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to
<>	not equal to

5.2.3.116 plant_functional_organization_assignment

A **plant_functional_organization_assignment** assigns an **organization** to one or more **product_definition**, **product_category**, **product_definition_relationship**, **external_source** or **action_resource**.

NOTE 1 – This entity satisfies the requirements for information about the roles played by an Organization stated in clause 4.2 of this part of ISO 10303, as follows:

- the maintainer in a Maintenance_of_identification_scheme (see 4.2.109);
- the Performer (see annex M, instance 537) of an Assess (see annex M, instance 1) or Design (see annex M, instance 2) Activity (see 4.2.7);
- the controller in a Control_of_information_content_by_organization (see 4.2.69);
- the owner in a Ownership_of_material_by_organization (see 4.2.120);
- the owner in a Ownership_of_intellectual_property_by_organization (see 4.2.119);
- the custodian in a Custody_of_material_by_organization (see 4.2.70);
- the operator in an Operation_of_facility_by_organization (see 4.2.113);
- an object that provides the context for a Hierarchy_of_composition_of_facility (see 4.2.92) or a Hierarchy_of_composition_of_material (see 4.2.93);
- an Identification_context_object (see 4.2.185.1) providing a context for an Identification_of_object_by-information_content (see 4.2.96).

EXPRESS specification:

```

*) 
ENTITY plant_functional_organization_assignment
  SUBTYPE OF (organization_assignment);
  items : SET [1:?] OF organization_item;
WHERE
  WR1: plant_functional_organization_correlation (SELF);
  WR2: SIZEOF (QUERY (pd_item <* QUERY (item <* SELF.items |
    ('PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF (item))
    AND (SELF.role.name = 'context for hierarchy'))) |
    NOT (
    SIZEOF (QUERY (pdr <* USEDIN (pd_item,
      'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') |
      'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN
      TYPEOF (pdr)
    )) >= 1
    ))) = 0;
  WR3: SIZEOF (QUERY (ex_item <* QUERY (item <* SELF.items |
    ('PLANT_FUNCTIONAL_DATA.EXTERNAL_SOURCE' IN TYPEOF (item))) |
    NOT (
    SIZEOF (USEDIN (ex_item, 'PLANT_FUNCTIONAL_DATA.' +
      'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1
    ))) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: The set of **product_definition**, **product_category**, **product_definition_relationship**, **external_source** or **action_resource** instances which are assigned to an **organization**.

Formal propositions:

WR1: The **plant_functional_data_organization_correlation** function that correlates roles of **organizations** with elements of product data shall be satisfied.

WR2: If the item is a **product_definition** and the role is ‘context for hierarchy’ then the **product_definition** shall be the **relating_product_definition** of at least one **specified_higher_usage_occurrence**.

WR3: If the item is an **external_source**, then the **external_source** shall be the source of at least one **external_identification**.

5.2.3.117 plant_functional_person_assignment

A **plant_functional_person_assignment** is a type of **person_assignment** that assigns a **person** to a set of one or more **action_resource**. This entity type satisfies the following requirements as stated in clause 4.2 of this part of ISO 10303:

- identification of a person as the provider of resources for design or check activities.

EXPRESS specification:

```
* )
ENTITY plant_functional_person_assignment
  SUBTYPE OF (person_assignment);
  items : SET [1:?] OF person_item;
WHERE
  WR1: plant_functional_person_correlation (SELF);
END_ENTITY;
(*
```

Attribute definitions:

items: The set of one or more **action_resource** to which a **person** is assigned.

Formal propositions:

WR1: The **plant_functional_data_person_correlation** function that correlates roles of persons with elements of product data shall be satisfied.

5.2.3.118 plant_functional_presented_item_with_association

A **plant_functional_presented_item_with_association** is a type of **presented_item** that identifies the aspects of product data within the scope of this part of ISO 10303 that may be presented with associativity to a given presentation element. This entity type satisfies the application specific information requirements stated in clause 4.2.135 of this part of ISO 10303, in the case where the annotation element is a curve, symbol, fill area or text.

EXPRESS specification:

```
* )
ENTITY plant_functional_presented_item_with_association
  SUBTYPE OF (presented_item);
  items : SET [1:?] OF item_for_presentation;
```

```

WHERE
WR1: SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM')) >= 1;
WR2: SIZEOF (QUERY (pir <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM') |
    NOT ('PLANT_FUNCTIONAL_DATA.PRESENTATION_WITH_ASSOCIATION'
        IN TYPEOF (pir.presentation)
    ))) = 0;
WR3: SIZEOF (QUERY (pd <* QUERY (item <* SELF.items |
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
    IN TYPEOF (item)) |
    NOT (
        pd\product_definition.frame_of_reference.name IN
        ['functional definition', 'functional occurrence',
        'physical definition', 'physical occurrence']
    ))) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: The items that are presented.

Formal propositions:

WR1: The **plant_functional_presented_item_with_association** shall be presented at least once.

WR2: The presentation of a **plant_functional_presented_item_with_association** shall be a **presentation_with_association**.

WR3: Each **product_definition** that is presented shall be a facility or a material.

5.2.3.119 plant_functional_presented_item

A **plant_functional_presented_item** is a type of **presented_item** that identifies the aspects of product data within the scope of this part of ISO 10303 that may be presented on a schematic diagram. This entity type satisfies the application specific information requirements stated in clause 4.2.135 of this part of ISO 10303, in the case where the annotation element is a drawing, drawing sheet or drawing view.

EXPRESS specification:

```

*)
ENTITY plant_functional_presented_item
SUBTYPE OF (presented_item);
    items : SET [1:?] OF item_for_presentation;
WHERE
    WR1: SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
        'PRESENTED_ITEM REPRESENTATION.ITEM')) >= 1;
    WR2: SIZEOF (QUERY (pir <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
        'PRESENTED_ITEM REPRESENTATION.ITEM') |
        NOT (
            SIZEOF (TYPEOF (pir.presentation) *
            ['PLANT_FUNCTIONAL_DATA.DRAWING_REVISION',

```

```
'PLANT_FUNCTIONAL_DATA.PRESENTATION_AREA',
'PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW'] ) = 1
))) = 0;
WR3: SIZEOF (QUERY (pd <* QUERY (item <* SELF.items |
'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
IN TYPEOF (item)) |
NOT (
pd\product_definition.frame_of_reference.name IN
['functional definition', 'functional occurrence',
'physical definition', 'physical occurrence']
))) = 0;
END_ENTITY;
(*
```

Attribute definitions:

items: The items that are presented.

Formal propositions:

WR1: The **plant_functional_presented_item** shall be presented at least once.

WR2: The presentation of a **plant_functional_presented_item** shall be a **drawing_revision**, **presentation_area** or **presentation_view**.

WR3: Each **product_definition** that is presented shall be a facility or a material.

5.2.3.120 plant_functional_property_classification_assignment

A **plant_functional_property_classification_assignment** is a type of **group_assignment** which assigns a set of properties to **class_of_property** in order to classify them. This entity type satisfies the application specific information requirements stated in clause 4.2.44 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_property_classification_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF class_of_property_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN  
    TYPEOF (SELF.assigned_group);  
END_ENTITY;  
(*
```

Attribute definitions:

items: the set of properties that are assigned to the **class_of_property**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_property_classification_assignment** shall be a **class_of_property**.

5.2.3.121 plant_functional_recognized_possession_of_property_assignment

A **plant_functional_possession_of_property_assignment** is a type of **group_assignment** that assigns a set of one or more **class_of_facility**, **class_of_material** or **class_of_activity** to a **class_of_property**, to indicate that such properties may be possessed by such facilities, materials, or activities. This entity type satisfies the application specific information requirements stated in clause 4.2.134 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY plant_functional_recognized_possession_of_property_assignment  
  SUBTYPE OF (group_assignment);  
  items : SET [1:?] OF possessed_class_of_property_item;  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN  
    TYPEOF (SELF.assigned_group);  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of **class_of_facility**, **class_of_material** or **class_of_activity** that are assigned to a **class_of_property**.

Formal propositions:

WR1: The **assigned_group** of a **plant_functional_possession_of_property_assignment** shall be a **class_of_property**.

5.2.3.122 plant_functional_transfer_material_destination_activity_assignment

A **plant_functional_transfer_material_destination_activity_assignment** is a type of **action_assignment** that relates a Transfer_material (see annex M, instance 3) Activity to a **product_definition**, where the involvement of the object is as the destination for the transfer.

EXPRESS specification:

```
*)  
ENTITY plant_functional_transfer_material_destination_activity_assignment  
  SUBTYPE OF (action_assignment);  
  item : transfer_source_destination_item;  
WHERE  
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,  
    'PLANT_FUNCTIONAL_DATA.' +  
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
    TYPEOF (act\group_assignment.assigned_group)) AND  
    (act\group_assignment.assigned_group.name = 'Transfer_material')) +  
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,  
    'PLANT_FUNCTIONAL_DATA.' +  
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
    ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
    TYPEOF (acm\group_assignment.assigned_group)) AND
```

```

        (acm\group_assignment.assigned_group.name = 'Transfer_material')
    )) = 1;
WR2: item\product_definition.frame_of_reference.name IN
    ['functional definition','functional occurrence',
     'physical definition','physical occurrence'];
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **product_definition** instances that are the destinations for the Transfer_material Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_transfer_material_destination_activity_assignment** shall be classified as a ‘Transfer_material’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_transfer_material_destination_activity_assignment** shall be classified as an ‘Transfer_material’ Activity.

WR1: Each **product_definition** that is identified as a destination of a ‘Transfer_material’ Activity shall be a Facility (see 4.2.89) or a Material (see 4.2.110).

5.2.3.123 plant_functional_transfer_material_source_activity_assignment

A **plant_functional_transfer_material_source_activity_assignment** is a type of **action_assignment** that relates a Transfer_material (see annex M, instance 3) Activity to a **product_definition**, where the involvement of the object is as the source for the trasnfer.

EXPRESS specification:

```

*)
ENTITY plant_functional_transfer_material_source_activity_assignment
SUBTYPE OF (action_assignment);
    item : transfer_source_destination_item;
WHERE
    WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
                                         'PLANT_FUNCTIONAL_DATA.' +
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                           ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                            TYPEOF (act\group_assignment.assigned_group)) AND
                           (act\group_assignment.assigned_group.name = 'Transfer_material'))
                  )) +
    SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
                                    'PLANT_FUNCTIONAL_DATA.' +
                                    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                           ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                            TYPEOF (acm\group_assignment.assigned_group)) AND
                           (acm\group_assignment.assigned_group.name = 'Transfer_material'))
                  )) = 1;
WR2: item\product_definition.frame_of_reference.name IN
    ['functional definition','functional occurrence',
     'physical definition','physical occurrence'];
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **product_definition** instances that are the sources for the Transfer_material Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_transfer_material_source_activity_assignment** shall be classified as a ‘Transfer_material’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_transfer_material_source_activity_assignment** shall be classified as an ‘Transfer_material’ Activity.

WR1: Each **product_definition** that is identified as a source of a ‘Transfer_material’ Activity shall be a Facility (see 4.2.89) or a Material (see 4.2.110).

5.2.3.124 plant_functional_transferred_material_activity_assignment

A **plant_functional_transferred_material_activity_assignment** is a type of **action_assignment** that relates a Transfer_material (see annex M, instance 3) Activity to a **product_definition**, where the involvement of the object is as the transferred Material.

EXPRESS specification:

```
*)  
ENTITY plant_functional_transferred_material_activity_assignment  
SUBTYPE OF (action_assignment);  
    items : SET [1:?] OF transfer_material_item;  
WHERE  
    WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,  
                                         'PLANT_FUNCTIONAL_DATA.' +  
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
                                         TYPEOF (act\group_assignment.assigned_group)) AND  
                                         (act\group_assignment.assigned_group.name = 'Transfer_material'))  
    )) +  
    SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,  
                                         'PLANT_FUNCTIONAL_DATA.' +  
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
                                         TYPEOF (acm\group_assignment.assigned_group)) AND  
                                         (acm\group_assignment.assigned_group.name = 'Transfer_material'))  
    )) = 1;  
    WR2: SIZEOF (QUERY (item <* SELF.items | NOT  
        (item\product_definition.frame_of_reference.frame_of_reference[1].name =  
         'process material')) = 0;  
END_ENTITY;  
(*
```

Attribute definitions:

items: the set of **product_definition** instances that are the transferred Materials in the Transfer_material Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_transferred_material_activity_assignment** shall be classified as a ‘Transfer_material’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_transferred_material_activity_assignment** shall be classified as an ‘Transfer_material’ Activity.

WR1: Each **product_definition** that is identified as a transferred Material shall be a **Process_material** (see annex M, instance 1440).

5.2.3.125 plant_functional_transform_material_input_activity_assignment

A **plant_functional_transform_material_input_activity_assignment** is a type of **action_assignment** that relates a **Transform_material** (see annex M, instance 4) Activity to a **product_definition**, where the involvement of the object is as the input to the transformation.

EXPRESS specification:

```

*) 
ENTITY plant_functional_transform_material_input_activity_assignment
SUBTYPE OF (action_assignment);
  items : SET [1:?] OF transform_material_item;
WHERE
  WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,
                                         'PLANT_FUNCTIONAL_DATA.' +
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                         TYPEOF (act\group_assignment.assigned_group)) AND
                                         (act\group_assignment.assigned_group.name = 'Transfer_material'))
                  )) +
  SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,
                                     'PLANT_FUNCTIONAL_DATA.' +
                                     'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |
                                     ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                     TYPEOF (acm\group_assignment.assigned_group)) AND
                                     (acm\group_assignment.assigned_group.name = 'Transfer_material'))
                  )) = 1;
  WR2: SIZEOF (QUERY (item <* SELF.items | NOT
                           (item\product_definition.frame_of_reference.frame_of_reference[1].name IN
                           ['process material','physical information carrier'])
                         )) = 0;
END_ENTITY;
(*

```

Attribute definitions:

items: the set of **product_definition** instances that are the input to the **Transform_material** Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_transform_material_input_activity_assignment** shall be classified as a ‘Transform_material’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_transform_material_input_activity_assignment** shall be classified as an ‘Transform_material’ Activity.

WR1: Each **product_definition** that is identified as an input to a ‘Transform_material’ Activity shall be a Process_material (see 4.2.136) or a Physical_information_carrier (see 4.2.124).

5.2.3.126 plant_functional_transform_material_output_activity_assignment

A **plant_functional_transform_material_output_activity_assignment** is a type of **action_assignment** that relates a Transform_material (see annex M, instance 4) Activity to a **product_definition**, where the involvement of the object is as the output from the transformation.

EXPRESS specification:

```
*)  
ENTITY plant_functional_transform_material_output_activity_assignment  
SUBTYPE OF (action_assignment);  
    items : SET [1:?] OF transform_material_item;  
WHERE  
    WR1: SIZEOF (QUERY (act <* USEDIN (SELF\action_assignment.assigned_action,  
                                         'PLANT_FUNCTIONAL_DATA.' +  
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
                                         TYPEOF (act\group_assignment.assigned_group)) AND  
                                         (act\group_assignment.assigned_group.name = 'Transform_material'))  
    )) +  
    SIZEOF (QUERY (acm <* USEDIN (SELF\action_assignment.assigned_action.chosen_method,  
                                         'PLANT_FUNCTIONAL_DATA.' +  
                                         'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') |  
                                         ('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  
                                         TYPEOF (acm\group_assignment.assigned_group)) AND  
                                         (acm\group_assignment.assigned_group.name = 'Transform_material'))  
    )) = 1;  
    WR2: SIZEOF (QUERY (item <* SELF.items | NOT  
                           (item\product_definition.frame_of_reference.frame_of_reference[1].name IN  
                           ['process material','physical information carrier'])  
    )) = 0;  
END_ENTITY;  
(*
```

Attribute definitions:

items: the set of **product_definition** instances that are the output from the Transform_material Activity.

Formal propositions:

WR1: The **action** that is assigned by a **plant_functional_transform_material_output_activity_assignment** shall be classified as a ‘Transform_material’ Activity, or the **action_method** of the **action** that is assigned by a **plant_functional_transform_material_output_activity_assignment** shall be classified as an ‘Transform_material’ Activity.

WR1: Each **product_definition** that is identified as an output from a ‘Transform_material’ Activity shall be a Process_material (see 4.2.136) or a Physical_information_carrier (see 4.2.124).

5.2.3.127 plant_functional_symbol_library_assignment

A **plant_functional_symbol_library_assignment** is a type of **library_assignment** that assigns a set of symbol definitions to a library of such objects.

EXPRESS specification:

```
* )
ENTITY plant_functional_symbol_library_assignment
SUBTYPE OF (library_assignment);
  items : SET [1:?] OF symbol_library_item;
WHERE
  WR1: SELF.frame_of_reference.library_reference =
    'library of symbols';
END_ENTITY;
(*
```

Attribute definitions:

items: The set of one or more **symbol_representations** which are assigned to the library.

Formal propositions:

WR1: The **library_segment_type** of the library shall be ‘library of symbols’.

5.2.3.128 plant_functional_typical_facility_catalogue_assignment

A **plant_functional_typical_facility_catalogue_assignment** is a type of **library_assignment** that assigns a set of typical facilities to a catalogue of such objects. This entity type satisfies the application specific information requirements stated in clause 4.2.54 of this part of ISO 10303, in the case where the members of the collection are typical facilities.

EXPRESS specification:

```
* )
ENTITY plant_functional_typical_facility_catalogue_assignment
SUBTYPE OF (library_assignment);
  items : SET [1:?] OF typical_facility_catalogue_item;
WHERE
  WR1: SELF.frame_of_reference.library_reference =
    'typical facility catalogue';
  WR2: SIZEOF (QUERY (p_d <* SELF.items |
    NOT (p_d\product_definition.frame_of_reference.name =
      'functional definition'
    ))) = 0;
END_ENTITY;
(*)
```

Attribute definitions:

items: The set of one or more **product_definition** instances which are assigned to the catalogue.

Formal propositions:

WR1: The **library_segment_type** of the catalogue shall be ‘typical facility catalogue’.

WR2: Each **product_definition** in the set of **items** shall be a typical facility.

5.2.3.129 plant_functional_typical_material_catalogue_assignment

A **plant_functional_typical_material_catalogue_assignment** is a type of **library_assignment** that assigns a set of typical material objects to a catalogue of such objects. This entity type satisfies the application specific information requirements stated in clause 4.2.55 of this part of ISO 10303, in the case where the members of the collection are typical materials.

EXPRESS specification:

```
*)  
ENTITY plant_functional_typical_material_catalogue_assignment  
  SUBTYPE OF (library_assignment);  
  items : SET [1:?] OF typical_material_catalogue_item;  
WHERE  
  WR1: SELF.frame_of_reference.library_reference =  
    'typical material catalogue';  
  WR2: SIZEOF (QUERY (p_d <* SELF.items |  
    NOT (p_d\product_definition.frame_of_reference.name =  
      'physical definition'  
    ))) = 0;  
END_ENTITY;  
(*
```

Attribute definitions:

items: The set of one or more **product_definition** instances which are assigned to the catalogue.

Formal propositions:

WR1: The **library_segment_type** of the catalogue shall be ‘typical material catalogue’.

WR2: Each **product_definition** in the set of **items** shall be a typical material.

5.2.3.130 point_in_space_of_material

An **point_in_space_of_material** is a type of **shape_aspect** and **shape_aspect_relationship** that describes the position of a material object. This entity type satisfies the application specific information requirements stated in clause 4.2.126 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY point_in_space_of_material  
  SUBTYPE OF (shape_aspect, shape_aspect_relationship);  
END_ENTITY;  
(*
```

5.2.3.131 point_in_space_of_resource_for_facility

An **point_in_space_of_resource_for_facility** is a type of **shape_aspect** and **shape_aspect_relationship** that describes the position of the material resource that implements a facility. This entity type satisfies the application specific information requirements stated in clause 4.2.117 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY point_in_space_of_resource_for_facility
SUBTYPE OF (shape_aspect, shape_aspect_relationship);
END_ENTITY;
(*
```

5.2.3.132 possession_of_facility_port

A **possession_of_facility_port** is a type of **product_definition_usage** and **product_definition** that associates a **product_definition** that defines a facility and a **facility_port**. It indicates that the **facility_port** is possessed by the facility. This entity type satisfies the application specific information requirements stated in clause 4.2.130 of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY possession_of_facility_port
  SUBTYPE OF (product_definition_usage,product_definition);
WHERE
  WR1: SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name IN
    ['functional definition','functional occurrence'];
  WR2: 'PLANT_FUNCTIONAL_DATA.FACILITY_PORT' IN
    TYPEOF (SELF\product_definition_relationship.
      related_product_definition);
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **relating_product_definition** of a **possession_of_facility_port** shall be a facility.

WR2: The **related_product_definition** of a **possession_of_facility_port** shall be a **facility_port**.

Informal propositions:

IP1: If the **description** of the **possession_of_facility_port** has the value ‘actual’, then the **possession_of_facility_port** exists or has existed.

IP2: If the **description** of the **possession_of_facility_port** has the value ‘intended’, then the **possession_of_facility_port** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.133 possession_of_feature_connector

A **possession_of_feature_connector** is a type of **annotation_occurrence_relationship** that associates a **connector_feature_annotation_occurrence** with the **annotation_occurrence** for which it is a connector. This entity type satisfies the application specific information requirements stated in clause 4.2.131 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY possession_of_feature_connector  

SUBTYPE OF (annotation_occurrence_relationship);  

WHERE  

    WR1: 'PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'  

        IN TYPEOF (SELF\annotation_occurrence_relationship.  

                    related_annotation_occurrence);  

    WR2: NOT (  

        'PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'  

        IN TYPEOF (SELF\annotation_occurrence_relationship.  

                    relating_annotation_occurrence));  

END_ENTITY;  

(*

```

Formal propositions:

WR1: The **related_annotation_occurrence** of a **possession_of_feature_connector** shall be a **connector_feature_annotation_occurrence**.

WR2: The **relating_annotation_occurrence** of a **possession_of_feature_connector** shall not be a **connector_feature_annotation_occurrence**.

5.2.3.134 presentation_view_with_clipping_box

A **presentation_view_with_clipping_box** is a type of **presentation_view** that includes a **planar_box** that specifies a rectangular area outside which items are not presented.

EXPRESS specification:

```

*)  

ENTITY presentation_view_with_clipping_box  

SUBTYPE OF (presentation_view);  

WHERE  

    WR1: SIZEOF (QUERY (item <* SELF\representation.items |  

        ('PLANT_FUNCTIONAL_DATA.PLANAR_BOX' IN TYPEOF (item)) AND  

        (item\representation_item.name = 'clipping box')  

        )) = 1;  

END_ENTITY;  

(*

```

Formal propositions:

Formal propositions:

WR1: **presentation_view_with_clipping_box** shall contain exactly one **planar_box** whose name is 'clipping box'

Informal propositions:

IP1: The **planar_box** specifies a rectangular area, outside whose limits elements are not presented.

5.2.3.135 presentation_with_association

A **presentation_with_association** is a type of **presentation_representation** that contains one **annotation_occurrence** that is associated with an aspect of product data to be presented.

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EXAMPLE 255 – A **presentation_association** may be used to associate the presentation of a pump symbol with a pump facility.

EXPRESS specification:

```
* )
ENTITY presentation_with_association -- taken from AP212
SUBTYPE OF (presentation_representation);
WHERE
  WR1: SIZEOF (SELF\representation.items) = 1;
  WR2: 'PLANT_FUNCTIONAL_DATA.ANNOTATION_OCCURRENCE' IN
    TYPEOF (SELF\representation.items[1]);
  WR3: SIZEOF (USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.PRESENTATION')) = 1;
  WR4: SIZEOF (QUERY (pir <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.PRESENTATION') |
    NOT (
      'PLANT_FUNCTIONAL_DATA.' +
      'PLANT_FUNCTIONAL_PRESENTED_ITEM_WITH_ASSOCIATION' IN
      TYPEOF (pir.item)
    ))) = 0;
END_ENTITY;
(*)
```

Formal propositions:

WR1: There shall be exactly one item in a **presentation_with_association**.

WR2: The item of a **presentation_with_association** shall be an **annotation_occurrence**.

WR3: The **presentation_with_association** shall present exactly one aspect of product data.

WR4: The aspect of product data that is presented shall be identified by a **plant_functional_presented_item_with_association**.

5.2.3.136 product_definition_alternative

A **product_definition_alternative** is a type of **product_definition_relationship** that relates one facility or material to another such that one is an alternative to the other. This entity type satisfies the application specific information requirements stated in clause 4.2.9 of this part of ISO 10303, in the case where the objects are facilities or materials.

EXPRESS specification:

```
* )
ENTITY product_definition_alternative
  SUBTYPE OF (product_definition_relationship);
WHERE
  WR1: SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name IN
    ['functional definition', 'functional occurrence',
     'physical definition', 'physical occurrence'];
  WR2: SELF\product_definition_relationship.
```

```

related_product_definition.frame_of_reference.name IN
['functional definition', 'functional occurrence',
'physical definition', 'physical occurrence'];
WR3: (NOT (SELF\product_definition_relationship.
relating_product_definition.frame_of_reference.name IN
['functional definition', 'functional occurrence'])) OR
(SELF\product_definition_relationship.
related_product_definition.frame_of_reference.name IN
['functional definition', 'functional occurrence']);
WR4: (NOT (SELF\product_definition_relationship.
relating_product_definition.frame_of_reference.name IN
['physical definition', 'physical occurrence'])) OR
(SELF\product_definition_relationship.
related_product_definition.frame_of_reference.name IN
['physical definition', 'physical occurrence']);
END_ENTITY;
(*

```

Attribute definitions:

SELF\product_definition_relationship.relating_product_definition: The source in the alternative association.

SELF\product_definition_relationship.related_product_definition: The alternate **product_definition** in the alternative association.

Formal propositions:

WR1: The **relating_product_definition** in a **product_definition_alternative** shall be a typical facility, specific facility, typical material, or specific material.

WR2: The **related_product_definition** in a **product_definition_alternative** shall be a typical facility, specific facility, typical material, or specific material.

WR3: If the **relating_product_definition** in a **product_definition_alternative** is a facility, then the **related_product_definition** shall be a facility.

WR4: If the **relating_product_definition** in a **product_definition_alternative** is a material, then the **related_product_definition** shall be a material.

5.2.3.137 product_definition_derivation

A **product_definition_derivation** is a type of **product_definition_relationship** that relates one facility or material to another such that one is a derivative of the other. This entity type satisfies the application specific information requirements stated in clause 4.2.76 of this part of ISO 10303, in the case where the objects are facilities or materials.

EXPRESS specification:

```

*)  
ENTITY product_definition_derivation  
SUBTYPE OF (product_definition_relationship);

```

```
WHERE
WR1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN
      ['functional definition', 'functional occurrence',
       'physical definition', 'physical occurrence'];
WR2: SELF\product_definition_relationship.
      related_product_definition.frame_of_reference.name IN
      ['functional definition', 'functional occurrence',
       'physical definition', 'physical occurrence'];
WR3: (NOT (SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name IN
            ['functional definition', 'functional occurrence'])) OR
      (SELF\product_definition_relationship.
            related_product_definition.frame_of_reference.name IN
            ['functional definition', 'functional occurrence']);
WR4: (NOT (SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name IN
            ['physical definition', 'physical occurrence'])) OR
      (SELF\product_definition_relationship.
            related_product_definition.frame_of_reference.name IN
            ['physical definition', 'physical occurrence']);
END_ENTITY;
(*
```

Attribute definitions:

SELF\product_definition_relationship.relating_product_definition: The source in the derivation association.

SELF\product_definition_relationship.related_product_definition: The derived **product_definition** in the derivation association.

Formal propositions:

WR1: The **relating_product_definition** in a **product_definition_derivation** shall be a typical facility, specific facility, typical material, or specific material.

WR2: The **related_product_definition** in a **product_definition_derivation** shall be a typical facility, specific facility, typical material, or specific material.

WR3: If the **relating_product_definition** in a **product_definition_derivation** is a facility, then the **related_product_definition** shall be a facility.

WR4: If the **relating_product_definition** in a **product_definition_derivation** is a material, then the **related_product_definition** shall be a material.

5.2.3.138 product_definition_version

A **product_definition_version** is a type of **product_definition_relationship** that relates one facility or material to another such that one is a version of the other. This entity type satisfies the application specific information requirements stated in clause 4.2.186 of this part of ISO 10303, in the case where the objects are facilities or materials.

EXPRESS specification:

```

*)  

ENTITY product_definition_version  

  SUBTYPE OF (product_definition_relationship);  

WHERE  

  WR1: SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name IN  

    ['functional definition', 'functional occurrence',  

     'physical definition', 'physical occurrence'];  

  WR2: SELF\product_definition_relationship.  

    related_product_definition.frame_of_reference.name IN  

    ['functional definition', 'functional occurrence',  

     'physical definition', 'physical occurrence'];  

  WR3: (NOT (SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name IN  

    ['functional definition', 'functional occurrence'])) OR  

    (SELF\product_definition_relationship.  

    related_product_definition.frame_of_reference.name IN  

    ['functional definition', 'functional occurrence']);  

  WR4: (NOT (SELF\product_definition_relationship.  

    relating_product_definition.frame_of_reference.name IN  

    ['physical definition', 'physical occurrence'])) OR  

    (SELF\product_definition_relationship.  

    related_product_definition.frame_of_reference.name IN  

    ['physical definition', 'physical occurrence']);  

END_ENTITY;  

(*

```

Attribute definitions:

SELF\product_definition_relationship.relating_product_definition: The source in the version association.

SELF\product_definition_relationship.related_product_definition: The variant **product_definition** in the version association.

Formal propositions:

WR1: The **relating_product_definition** in a **product_definition_version** shall be a typical facility, specific facility, typical material, or specific material.

WR2: The **related_product_definition** in a **product_definition_version** shall be a typical facility, specific facility, typical material, or specific material.

WR3: If the **relating_product_definition** in a **product_definition_version** is a facility, then the **related_product_definition** shall be a facility.

WR4: If the **relating_product_definition** in a **product_definition_version** is a material, then the **related_product_definition** shall be a material.

5.2.3.139 property_by_member

A **property_by_member** is a type of **property_definition** that assigns a property to a **collection_of_material** or a **collection_of_facility** in order to specify that the property is possessed by each member of the collection. This may be specified:

- if the members of the collection, and their relationship to the collection, are explicitly described: in this case, the property is assigned to one association between the collection and one of its members, and is asserted for all other members of the collection;
- if the members of the collection, and their relationship to the collection, are not explicitly described: in this case, the property is assigned to the collection.

This entity type satisfies the application specific information requirements stated in clause 4.2.133 of this part of ISO.

EXAMPLES

256 – A collection of bolts is identified, without explicit representation of the individual bolts. The mass of each bolt is specified as a **property_by_member** for the **product_definition** that represents the collection.

257 – A collection consisting of two pumps is specified as follows:

- an instance of **product_definition** that represents the collection;
- two instances of **product_definition** that represent the two pumps;
- two instances of **product_definition_relationship** that represent the associations between the two pumps and the collection.

The access envelope (shape property) of each pump is specified as a **property_by_member** for one of the **product_definition_relationship** instances that relates the collection to one of its members.

EXPRESS specification:

```
*)  
ENTITY property_by_member  
  SUBTYPE OF (property_definition);  
WHERE  
  WR1: (NOT ('PLANT_FUNCTION_SCHEMA.PRODUCT_DEFINITION_RELATIONSHIP' IN  
             TYPEOF (SELF.definition))) OR  
        (SIZEOF (TYPEOF (SELF.definition)) *  
         ['PLANT_FUNCTION_SCHEMA.COLLECTION_OF_MATERIAL',  
          'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_FACILITY']) = 1);  
  WR2: (NOT ('PLANT_FUNCTION_SCHEMA.PRODUCT_DEFINITION' IN  
             TYPEOF (SELF.definition))) OR  
        (SIZEOF (QUERY (pdr <* USEDIN (SELF, 'PLANT_FUNCTION_SCHEMA.' +  
                                         'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION') |  
                                         (SIZEOF (TYPEOF (pdr)) *  
                                          ['PLANT_FUNCTION_SCHEMA.COLLECTION_OF_MATERIAL',  
                                           'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_FACILITY']) > 0)  
           )) = 0 );
```

```
END_ENTITY;
(*
```

Formal propositions:

WR1: If the **property_by_member** characterizes a **product_definition_relationship**, then the characterized relationship shall be a **collection_of_material** or a **collection_of_facility**.

WR2: If the **property_by_member** characterizes a **product_definition**, then the characterized definition shall not be the **relating_product_definition** (the whole) in a **collection_of_material** or a **collection_of_facility**.

5.2.3.140 property_definition_alternative

A **product_definition_alternative** is a type of **property_definition_relationship** that relates one property to another such that one is an alternative to the other. This entity type satisfies the application specific information requirements stated in clause 4.2.9 of this part of ISO 10303, in the case where the objects are properties.

EXPRESS specification:

```
*)  
ENTITY property_definition_alternative  
  SUBTYPE OF (property_definition_relationship);  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\property_definition_relationship.relating_property_definition: The source in the alternative association.

SELF\property_definition_relationship.related_property_definition: The alternate **property_definition** in the alternative association.

5.2.3.141 property_definition_derivation

A **product_definition_derivation** is a type of **property_definition_relationship** that relates one property to another such that one is a derivative of the other. This entity type satisfies the application specific information requirements stated in clause 4.2.76 of this part of ISO 10303, in the case where the objects are properties.

EXPRESS specification:

```
*)  
ENTITY property_definition_derivation  
  SUBTYPE OF (property_definition_relationship);  
END_ENTITY;  
(*
```

Attribute definitions:

SELF\property_definition_relationship.relating_property_definition: The source in the derivation association.

SELF\property_definition_relationship.related_property_definition: The derived **property_definition** in the derivation association.

5.2.3.142 property_definition_version

A **product_definition_version** is a type of **property_definition_relationship** that relates one property to another such that one is a variant on the other. This entity type satisfies the application specific information requirements stated in clause 4.2.186 of this part of ISO 10303, in the case where the objects are properties.

EXPRESS specification:

```
* )
ENTITY property_definition_version
  SUBTYPE OF (property_definition_relationship);
END_ENTITY;
(*
```

Attribute definitions:

SELF\property_definition_relationship.relating_property_definition: The source in the version association.

SELF\property_definition_relationship.related_property_definition: The variant **property_definition** in the version association.

5.2.3.143 provision_of_service

A **provision_of_service** is a type of **product_definition_relationship** and **product_definition** that identifies a relationship between a material object and a facility object that indicates the material is, or is intended to be, the resource that provides the facility. This entity type satisfies the application specific information requirements stated in clause 4.2.139 of this part of ISO.

EXPRESS specification:

```
* )
ENTITY provision_of_service
  SUBTYPE OF (product_definition_relationship,product_definition);
WHERE
  WR1: SELF.relatting_product_definition.frame_of_reference.name IN
    ['functional definition', 'functional occurrence'];
  WR2: SELF.related_product_definition.frame_of_reference.name IN
    ['physical definition', 'physical occurrence'];
  WR3: (SELF.relatting_product_definition.frame_of_reference.name <>
    'functional definition') OR
    (SELF.related_product_definition.frame_of_reference.name =
      'physical definition');
  WR4: (SELF.relatting_product_definition.frame_of_reference.name <>
    'functional occurrence') OR
    (SELF.related_product_definition.frame_of_reference.name =
      'physical occurrence');
END_ENTITY;
```

(*

Formal propositions:

WR1: The **relating_product_definition** of a **provision_of_service** shall be a typical facility or a specific facility.

WR2: The **related_product_definition** of a **provision_of_service** shall be a typical material or a specific material.

WR3: If the **relating_product_definition** of a **provision_of_service** is a typical facility, then the **related_product_definition** shall be a typical material.

WR4: If the **relating_product_definition** of a **provision_of_service** is a specific facility, then the **related_product_definition** shall be a specific material.

Informal propositions:

IP1: If the **description** of the **provision_of_service** has the value ‘actual’, then the **provision_of_service** exists or has existed.

IP2: If the **description** of the **provision_of_service** has the value ‘intended’, then the **provision_of_service** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.144 realization_of_intended_activity_by_actual

A **realization_of_intended_activity_by_actual** is type of **action_relationship** that relates an intended activity to an actual activity. This entity type satisfies the application specific information requirements stated in clause 4.2.140 of this part of ISO 10303, in the case where the intended and actual objects are both specific activities.

EXPRESS specification:

```
* )
ENTITY realization_of_intended_activity_by_actual
  SUBTYPE OF (action_relationship);
WHERE
  WR1: SELF.relating_action.description = 'intended';
  WR2: SELF.related_action.description = 'actual';
END_ENTITY;
(*)
```

Formal propositions:

WR1: The life-cycle qualifier of the **relating_action** shall be ‘intended’.

WR2: The life-cycle qualifier of the **related_action** shall be ‘actual’.

5.2.3.145 realization_of_intended_facility_or_material_by_actual

A **realization_of_intended_facility_or_material_by_actual** is type of **action_relationship** that relates an intended facility or material to an actual facility or material. This entity type satisfies the application specific information requirements stated in clause 4.2.140 of this part of ISO 10303, in the case where the intended and actual objects are facilities or materials.

EXPRESS specification:

```
*)  
ENTITY realization_of_intended_facility_or_material_by_actual  
  SUBTYPE OF (product_definition_relationship);  
WHERE  
  WR1: SELF.relating_product_definition.description = 'intended';  
  WR2: SELF.related_product_definition.description = 'actual';  
  WR3: SELF\product_definition_relationship.  
    relating_product_definition.frame_of_reference.name IN  
    ['functional occurrence',  
     'physical occurrence'];  
  WR4: SELF\product_definition_relationship.  
    related_product_definition.frame_of_reference.name IN  
    ['functional definition', 'functional occurrence',  
     'physical definition', 'physical occurrence'];  
  WR5: (NOT (SELF\product_definition_relationship.  
    relating_product_definition.frame_of_reference.name =  
    'functional occurrence')) OR  
    (SELF\product_definition_relationship.  
    related_product_definition.frame_of_reference.name IN  
    ['functional definition', 'functional occurrence']);  
  WR6: (NOT (SELF\product_definition_relationship.  
    relating_product_definition.frame_of_reference.name =  
    'physical occurrence')) OR  
    (SELF\product_definition_relationship.  
    related_product_definition.frame_of_reference.name IN  
    ['physical definition', 'physical occurrence']);  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The life-cycle qualifier of the **relating_product_definition** shall be ‘intended’.

WR2: The life-cycle qualifier of the **related_product_definition** shall be ‘actual’.

WR3: The **relating_product_definition** in a **realization_of_intended_facility_or_material_by_actual** shall be a specific facility or a specific material.

WR4: The **related_product_definition** in a **realization_of_intended_facility_or_material_by_actual** shall be a typical facility, specific facility, typical material, or specific material.

WR5: If the **relating_product_definition** in a **realization_of_intended_facility_or_material_by_actual** is a facility, then the **related_product_definition** shall be a facility.

WR6: If the **relating_product_definition** in a **realization_of_intended_facility_or_material_by_actual** is a material, then the **related_product_definition** shall be a material.

5.2.3.146 recognized_class_of_resource

A **recognized_class_of_resource** is a type of **product_related_product_category** that associates a **product** that is a facility and a **class_of_material**, and indicates the facility has, or is intended to have, a resource of the class. This entity type satisfies the application specific information requirements stated in clause 4.2.144 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY recognized_class_of_resource  
  SUBTYPE OF (product_related_product_category);  
WHERE  
  WR1: SELF.name = 'resource for facility';  
  WR2: SIZEOF (QUERY (pcr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') |  
    ((pcr.name = 'class assignment') AND  
     ('PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN  
      TYPEOF (pcr.sub_category)))  
    )) >= 1;  
  WR3: SIZEOF (SELF.products) = 1;  
  WR4: SIZEOF (QUERY (pdf <* USEDIN (SELF.products[1],  
    'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') |  
    NOT (  
      SIZEOF (QUERY (pd <* USEDIN (pdf,  
        'PLANT_FUNCTIONAL_DATA.' +  
        'PRODUCT_DEFINITION.FORMATION') |  
        NOT (  
          pd\product_definition.frame_of_reference.name IN  
          ['physical definition', 'physical occurrence'])  
        ))) = 0  
      ))) = 0;  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The name of the **recognized_class_of_resource** shall be 'resource for facility'.

WR2: The **recognized_class_of_resource** shall be the **category** in at least one **product_category_relationship**, which shall have the name 'class assignment' and have as **sub_category** a **class_of_material**.

WR3: The **recognized_class_of_resource** shall be related to exactly one **product**.

WR4: The **product** that is related to the **recognized_class_of_resource** shall be defined as a **material**.

Informal propositions:

IP1: If the **description** of the **recognized_class_of_resource** has the value ‘actual’, then the **recognized_class_of_resource** exists or has existed.

IP2: If the **description** of the **recognized_class_of_resource** has the value ‘intended’, then the **recognized_class_of_resource** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_category** entity data type.

5.2.3.147 **recognized_class_of_service**

A **recognized_class_of_service** is a type of **product_related_product_category** that associates **product** that is a material object and a **class_of_facility**, and indicates that the material is, or is intended to be, a resource for a facility of the class. This entity type satisfies the application specific information requirements stated in clause 4.2.145 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY recognized_class_of_service  
  SUBTYPE OF (product_related_product_category);  
WHERE  
  WR1: SELF.name = 'service for material';  
  WR2: SIZEOF (QUERY (pcr <* USEDIN (SELF, 'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') |  
    ((pcr.name = 'class assignment') AND  
     ('PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
      TYPEOF (pcr.sub_category)))  
    )) >= 1;  
  WR3: SIZEOF (SELF.products) = 1;  
  WR4: SIZEOF (QUERY (pdf <* USEDIN (SELF.products[1],  
    'PLANT_FUNCTIONAL_DATA.' +  
    'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') |  
    NOT (  
      SIZEOF (QUERY (pd <* USEDIN (pdf,  
        'PLANT_FUNCTIONAL_DATA.' +  
        'PRODUCT_DEFINITION.FORMATION') |  
        NOT (  
          pd\product_definition.frame_of_reference.name IN  
          ['functional definition', 'functional occurrence']  
        ))) = 0  
      ))) = 0;  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The name of the **recognized_class_of_service** shall be ‘service for material’

WR2: The **recognized_class_of_service** shall be the **category** in at least one **product_category_relationship**, which shall have the name ‘class assignment’ and have as **sub_category** a **class_of_facility**.

WR3: The **recognized_class_of_service** shall be related to exactly one **product**.

WR4: The product that is related to the **recognized_class_of_service** shall be defined as a facility.

Informal propositions:

IP1: If the **description** of the **recognized_class_of_service** has the value ‘actual’, then the **recognized_class_of_service** exists or has existed.

IP2: If the **description** of the **recognized_class_of_service** has the value ‘intended’, then the **recognized_class_of_service** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_category** entity data type.

5.2.3.148 **recognized_provision_of_service_according_to_class**

A **recognized_provision_of_service_according_to_class** is a type of **product_category_relationship** that associates a **class_of_material** with a **class_of_facility** such that the members of the **class_of_material** are potential providers of the services specified by the members of the **class_of_material**. This entity type satisfies the application specific information requirements stated in clause 4.2.157 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY recognized_provision_of_service_according_to_class  
  SUPERTYPE OF (ONEOF  
    externally_defined_recognized_provision_of_service_according_to_class))  
  SUBTYPE OF (product_category_relationship);  
WHERE  
  WR1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN  
    TYPEOF (SELF\product_category_relationship.category);  
  WR2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN  
    TYPEOF (SELF\product_category_relationship.sub_category);  
END_ENTITY;  
(*
```

Formal propositions:

WR1: The **category** of a **recognized_provision_of_service_according_to_class** shall be a **class_of_facility**.

WR2: The **sub_category** of a **recognized_provision_of_service_according_to_class** shall be a **class_of_material**.

5.2.3.149 **reference_between_page_connector**

A **reference_between_page_connector** is a type of **annotation_occurrence_relationship** that associates two instances of **page_connector** and asserts a reference between them. This entity type satisfies the application specific information requirements stated in clause 4.2.159 of this part of ISO 10303.

EXPRESS specification:

```
*)  
ENTITY reference_between_page_connector
```

```
SUBTYPE OF (annotation_occurrence_relationship);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.PAGE_CONNECTOR'
    IN TYPEOF (SELF.relating_annotation_occurrence);
  WR2: 'PLANT_FUNCTIONAL_DATA.PAGE_CONNECTOR'
    IN TYPEOF (SELF.related_annotation_occurrence);
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **relating_annotation_occurrence** of a **reference_between_page_connector** shall be a **page_connector**.

WR2: The **related_annotation_occurrence** of a **reference_between_page_connector** shall be a **page_connector**.

5.2.3.150 representation_alternative

A **representation_alternative** is a type of **representation_relationship** that relates one **representation** to another such that one is a alternate for the other. This entity type satisfies the application specific information requirements stated in clause 4.2.9 of this part of ISO 10303, in the case where the objects are information content.

EXPRESS specification:

```
*)
ENTITY representation_alternative
  SUBTYPE OF (representation_relationship);
END_ENTITY;
(*)
```

Attribute definitions:

SELF\representation_relationship.rep_1: The source in the alternative association.

SELF\representation_relationship.rep_2: The alternate **representation** in the alternative association.

5.2.3.151 representation_derivation

A **representation_derivation** is a type of **representation_relationship** that relates one **representation** to another such that one is a derivative of the other. This entity type satisfies the application specific information requirements stated in clause 4.2.76 of this part of ISO 10303, in the case where the objects are information content.

EXPRESS specification:

```
*)
ENTITY representation_derivation
  SUBTYPE OF (representation_relationship);
END_ENTITY;
(*)
```

Attribute definitions:

SELF\representation_relationship.rep_1: The source in the derivation association.

SELF\representation_relationship.rep_2: The derived **representation** in the derivation association.

5.2.3.152 representation_version

A **representation_version** is a type of **representation_relationship** that relates one **representation** to another such that one is a variant on the other. This entity type satisfies the application specific information requirements stated in clause 4.2.186 of this part of ISO 10303, in the case where the objects are information content.

EXPRESS specification:

```
* )
ENTITY representation_version
  SUBTYPE OF (representation_relationship);
END_ENTITY;
(*
```

Attribute definitions:

SELF\representation_relationship.rep_1: The source in the version association.

SELF\representation_relationship.rep_2: The variant **representation** in the version association.

5.2.3.153 standard_class_of_activity

A **standard_class_of_activity** is a **class_of_activity** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_activity
  SUBTYPE OF (class_of_activity, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group.name: The name of the **standard_class_of_activity**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_activity**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_activity**, inherited from **group**, shall be a keyword listed in table M.1.

5.2.3.154 standard_class_of_annotation_element

A **standard_class_of_annotation_element** is a **class_of_annotation_element** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_annotation_element
SUBTYPE OF (class_of_annotation_element, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*
```

Attribute definitions:

SELF\group.name: The name of the **standard_class_of_annotation_element**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_annotation_element**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_annotation_element**, inherited from **group**, shall be a keyword listed in table M.2.

5.2.3.155 standard_class_of_facility

A **standard_class_of_facility** is a **class_of_facility** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_facility
  SUBTYPE OF (class_of_facility, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*)
```

Attribute definitions:

SELF\product_category.name: The name of the **standard_class_of_facility**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_facility**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_facility**, inherited from **group**, shall be a keyword listed in table M.3.

5.2.3.156 standard_class_of_information_content

A **standard_class_of_information_content** is a **class_of_information_content** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_information_content
  SUBTYPE OF (class_of_information_content, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*
```

Attribute definitions:

SELF\group.name: The name of the **standard_class_of_information_content**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_information_content**, inherited from **pre_defined_item** shall be ‘ISO 10303-221 standard data’.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_information_content**, inherited from **group**, shall be a keyword listed in table M.4.

5.2.3.157 standard_class_of_involvement

A **standard_class_of_involvement** is a **class_of_involvement** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_involvement
  SUBTYPE OF (class_of_involvement, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group.name: The name of the **standard_class_of_involvement**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_involvement**, inherited from **pre_defined_item** shall be ‘ISO 10303-221 standard data’.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_involvement**, inherited from **group**, shall be a keyword listed in table M.5.

5.2.3.158 standard_class_of_material

A **standard_class_of_material** is a **class_of_material** that is specified in annex M of this part of ISO 10303.

A **standard_class_of_material** may be a **class_of_substance**.

EXPRESS specification:

```
* )
ENTITY standard_class_of_material
  SUBTYPE OF (class_of_material, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*
```

Attribute definitions:

SELF\product_category.name: The name of the **standard_class_of_material**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_material**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_material**, inherited from **group**, shall be a keyword listed in table M.6 (specified instances of Class_of_Material) or M.8 (specified instances of Class_of_Substance).

The keyword shall be from the table M.8 only if the **standard_class_of_material** is a **class_of_substance**.

5.2.3.159 standard_class_of_property

A **standard_class_of_property** is a **class_of_property** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_class_of_property
  SUBTYPE OF (class_of_property, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*)
```

Attribute definitions:

SELF\group.name: The name of the **standard_class_of_property**.

Formal propositions:

WR1: The **name** attribute of the **standard_class_of_property**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_name: The **name** attribute of the of the **standard_class_of_property**, inherited from **group**, shall be a keyword listed in table M.7.

5.2.3.160 standard_classification_of_class_of_annotation_element

A **standard_classification_of_class_of_annotation_element** is a type of **classification_of_class_of_annotation_element** that identifies the nature of the classification from a predefined list.

EXPRESS specification:

```
* )
ENTITY standard_classification_of_class_of_annotation_element
  SUBTYPE OF (classification_of_class_of_annotation_element, pre_defined_item);
WHERE
  WR1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*
```

Attribute definitions:

SELF\group_relationship.name: the name of the **standard_classification_of_class_of_annotation_element**. The values of this attribute and their meanings are specified in annex M of this part of ISO 10303.

Formal propositions:

WR1: the name of the **standard_classification_of_class_of_annotation_element** (inherited from **pre-defined_item**) shall be 'ISO 10303-221 standard data'.

5.2.3.161 standard_classification_of_class_of_facility

A **standard_classification_of_class_of_facility** is a **classification_of_class_of_facility** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_classification_of_class_of_facility
  SUBTYPE OF (classification_of_class_of_facility, pre_defined_item);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_FACILITY' IN
    TYPEOF (SELF\group_relationship.relating_group);
  WR2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_FACILITY' IN
    TYPEOF (SELF\group_relationship.related_group);
  WR3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **relating_group** of a **standard_classification_of_class_of_facility** shall be a **standard_class_of_facility**.

WR2: The **related_group** of a **standard_classification_of_class_of_facility** shall be a **standard_class_of_facility**.

WR3: The **name** of a **standard_classification_of_class_of_facility**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_relationship: The **name** attribute of the **group** referenced as the **relating_group** shall be a keyword listed in the ‘classifier’ column of table M.11.

The **name** attribute of the **group** referenced as the **related_group** shall be a keyword listed in the ‘classified’ column of table M.11, that is paired with the **name** of the **relating_group**.

5.2.3.162 standard_classification_of_class_of_material

A **standard_classification_of_class_of_material** is a **classification_of_class_of_material** that is specified in annex M of this part of ISO 10303.

EXPRESS specification:

```
* )
ENTITY standard_classification_of_class_of_material
  SUBTYPE OF (classification_of_class_of_material, pre_defined_item);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\group_relationship.relativ_group);
  WR2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_MATERIAL' IN
    TYPEOF (SELF\group_relationship.related_group);
  WR3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY;
(*
```

Formal propositions:

WR1: The **relating_group** of a **standard_classification_of_class_of_material** shall be a **standard_class_of_material**.

WR2: The **related_group** of a **standard_classification_of_class_of_material** shall be a **standard_class_of_material**.

WR3: The **name** of a **standard_classification_of_class_of_material**, inherited from **pre_defined_item**, shall be ‘ISO 10303-221 standard data’.

Informal propositions:

standard_relationship: The **name** attribute of the **group** referenced as the **relating_group** shall be a keyword listed in the ‘classifier’ column of table M.12.

The **name** attribute of the **group** referenced as the **related_group** shall be a keyword listed in the ‘classified’ column of table M.12, that is paired with the **name** of the **relating_group**.

5.2.3.163 standard_involvement_in_activity_class_constraint

A **standard_involvement_in_activity_class_constraint** is a type of **involvement_in_activity_class_constraint** that is identified from a pre-defined list specified in annex M of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY standard_involvement_in_activity_class_constraint  

  SUBTYPE OF (involvement_in_activity_class_constraint,  

              pre_defined_item);  

WHERE  

  WR1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN  

        TYPEOF (SELF\group_relationship.relating_group);  

  WR2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ININVOLVEMENT' IN  

        TYPEOF (SELF\group_relationship.related_group);  

  WR3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';  

END_ENTITY;  

(*

```

Formal propositions:

WR1: The **relating_group** of a **standard_involvement_in_activity_class_constraint** shall be a **standard_class_of_activity**.

WR2: The **related_group** of a **standard_involvement_in_activity_class_constraint** shall be a **standard_class_of_involvement**.

WR3: The **name** of the **involvement_in_activity_class_constraint**, inherited from **pre_defined_item**, shall be 'ISO 10303-221 standard data'.

Informal propositions:

standard_relationship: The **name** attribute of the **group** referenced as the **relating_group** shall be a keyword listed in the 'activity' column of table M.10.

The **name** attribute of the **group** referenced as the **related_group** shall be a keyword listed in the 'involvement' column of table M.10, that is paired with the **name** of the **relating_group**.

5.2.3.164 topological_sequence_of_facility

A **topological_sequence_of_facility** is a type of **product_definition** and **product_definition_relationship** that identifies two facilities as forming a topological sequence, and is related to a third facility that provides the context for the sequence. This entity type satisfies the application specific information requirements stated in clause 4.2.176 of this part of ISO 10303.

EXPRESS specification:

```

*)  

ENTITY topological_sequence_of_facility  

  SUBTYPE OF (product_definition,  

              product_definition_relationship);  

WHERE  

  WR1: SELF\product_definition_relationship.  

        relating_product_definition.  

        frame_of_reference.name IN  

        ['functional definition', 'functional occurrence'];  

  WR2: SELF\product_definition_relationship.  

        related_product_definition.  

        frame_of_reference.name IN

```

```

[ 'functional definition', 'functional occurrence' ];
WR3: SIZEOF (QUERY (pdr <* USEDIN (SELF,
'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
'RELATED_PRODUCT_DEFINITION') |
((pdr.name = 'context for sequence') AND
(pdr.relating_product_definition.frame_of_reference.name IN
['functional definition', 'functional occurrence'])) )
)) >= 1;
END_ENTITY;
(*

```

Formal propositions:

WR1: The **relating_product_definition** of a **topological_sequence_of_facility** shall be a facility.

WR2: The **relating_product_definition** of a **topological_sequence_of_facility** shall be a facility.

WR3: A **topological_sequence_of_facility** shall be the **related_product_definition** of at least one **product_definition_relationship** whose name is 'context for sequence', and whose **relating_product_definition** is a **facility**.

5.2.3.165 usage_of_facility_in_connection

A **usage_of_facility_in_connection** is a type of **product_definition_relationship** that associates a **product_definition** that defines a facility, and a **connection_of_facility**, indicating that the facility is involved in making the connection.

EXPRESS specification:

```

*) 
ENTITY usage_of_facility_in_connection
  SUBTYPE OF (product_definition_relationship,product_definition);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY' IN
    TYPEOF (SELF.relating_product_definition);
  WR2: SELF.related_product_definition.frame_of_reference.name IN
    ['functional definition', 'functional occurrence'];
END_ENTITY;
(*

```

Formal propositions:

WR1: The **relating_product_definition** of a **usage_of_facility_in_connection** shall be a **connection_of_facility**.

WR2: The **related_product_definition** of a **usage_of_facility_in_connection** shall be a facility.

Informal propositions:

IP1: If the **description** of the **usage_of_facility_in_connection** has the value 'actual', then the **usage_of_facility_in_connection** exists or has existed.

IP2: If the **description** of the **usage_of_facility_in_connection** has the value 'intended', then the **usage_of_facility_in_connection** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.166 usage_of_feature_in_connection

A **usage_of_feature_in_connection** is a type of **shape_aspect_relationship** and **shape_aspect** that identifies the usage of a **shape_aspect** in a connection.

EXPRESS specification:

```
* )
ENTITY usage_of_feature_in_connection
  SUBTYPE OF (shape_aspect_relationship, shape_aspect);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_SHAPE_ASPECT' IN
    TYPEOF (SELF\shape_aspect_relationship.relatting_shape_aspect);
END_ENTITY;
(*
```

Formal propositions:

WR1: The **relating_shape_aspect** of a **usage_of_feature_in_connection** shall be a **connection_shape_aspect**.

5.2.3.167 usage_of_facility_in_connection

5.2.3.168 usage_of_material_in_connection

A **usage_of_material_in_connection** is a type of **product_definition_relationship** that associates a **product_definition** that defines a material, and a **connection_of_material**, indicating that the material is involved in making the connection.

EXPRESS specification:

```
* )
ENTITY usage_of_material_in_connection
  SUBTYPE OF (product_definition_relationship, product_definition);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL' IN
    TYPEOF (SELF.relatting_product_definition);
  WR2: SELF.related_product_definition.frame_of_reference.name IN
    ['physical definition', 'physical occurrence'];
END_ENTITY;
(*)
```

Formal propositions:

WR1: The **relating_product_definition** of a **usage_of_material_in_connection** shall be a **connection_of_material**.

WR2: The **related_product_definition** of a **usage_of_material_in_connection** shall be a material.

Informal propositions:

IP1: If the **description** of the **usage_of_material_in_connection** has the value ‘actual’, then the **usage_of_material_in_connection** exists or has existed.

IP2: If the **description** of the **usage_of_material_in_connection** has the value ‘intended’, then the **usage_of_material_in_connection** is intended to exist in the future.

NOTE 1 – The **description** attribute is inherited from the **product_definition_relationship** entity data type.

5.2.3.169 view_dependent_invisibility

A **view_dependent_invisibility** is a type of **context_dependent_invisibility** that specifies that a set of **annotation_occurrence** and **presentation_layer_assignment** are invisible as they are associated with a given **presentation_view**.

EXPRESS specification:

```
* )
ENTITY view_dependent_invisibility
  SUBTYPE OF (context_dependent_invisibility);
WHERE
  WR1: 'PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW'
    IN TYPEOF (SELF.presentation_context);
  WR2: SIZEOF (QUERY (item <* SELF\invisibility.invisible_items |
    NOT (
      SIZEOF (TYPEOF (item) *
        [ 'PLANT_FUNCTIONAL_DATA.ANNOTATION_OCCURRENCE',
          'PLANT_FUNCTIONAL_DATA.PRESENTATION_LAYER_ASSIGNMENT' ]) = 1
        ))) = 0;
END_ENTITY;
(*
```

Formal propositions:

WR1: The context for the invisibility shall be a **presentation_view**.

WR2: The invisible items shall be **annotation_occurrence** or **presentation_layer_assignment**.

5.2.3.170 plant_functional_schema imported entity modifications

5.2.3.170.1 coordinated_universal_time_offset

The base definition of the entity **coordinated_universal_time_offset** is given in ISO 10303-41. The following modifications apply to this part of ISO 10303.

The coordinated universal time that forms the basis for dates and times shall be Greenwich Mean Time (GMT).

EXAMPLE 258 – The local time in the time zone that covers the eastern seaboard of the United States is defined as being 5 hours behind GMT, except during periods of daylight savings, when the offset is 4 hours.

5.2.4 plant functional schema rule definitions

5.2.4.1 activity_life_cycle

The **activity_life_cycle** rule specifies that each instance of **action** shall have the life-cycle qualifier ‘intended’ or ‘actual’, and that each instance of **action_method** shall have the life-cycle qualifier ‘actual’.

EXPRESS specification:

```
*)  
RULE activity_life_cycle FOR  
  (action, action_method);  
WHERE  
  WR1: SIZEOF (QUERY (act <* action |  
    NOT (act.description IN ['intended', 'actual'])  
  )) = 0;  
  WR2: SIZEOF (QUERY (acm <* action_method |  
    NOT (acm.description = 'actual')  
  )) = 0;  
END_RULE;  
(*
```

Argument definitions:

action: the set of all instances of the **action** entity.

action_method: the set of all instances of the **action_method** entity.

Formal propositions:

WR1: The **description** of each **action** shall be ‘intended’ or ‘actual’.

WR2: The **description** of each **action_method** shall be ‘actual’.

5.2.4.2 actual_or_intended_effectivity

0

The **actual_or_intended_effectivity** rule constrains instances of **effectivity** such that every **effectivity** has the life-cycle qualifier ‘actual’ or ‘intended’.

EXPRESS specification:

```
*)  
RULE actual_or_intended_effectivity FOR  
  (effectivity);  
WHERE  
  WR1: SIZEOF (QUERY (e <* effectivity |  
    NOT (e.description in ['actual', 'intended'])  
  )) = 0;  
END_RULE;  
(*
```

Argument definitions:

effectivity: the set of all instances of the **effectivity** entity data type.

Formal propositions:

WR1: The description of each **effectivity** shall be ‘intended’ or ‘actual’.

5.2.4.3 approval_status_constraint

The nexpapproval_status_constraint rule specifies that each instance of **approval_status** shall have the value ‘passed’ or ‘rejected’ in its **name** attribute.

EXPRESS specification:

```
* )
RULE approval_status_constraint FOR
  (approval_status);
WHERE
  WR1: SIZEOF (QUERY (stat <* approval_status |
    NOT (stat.name IN ['passed', 'rejected']))
  ))=0;
END_RULE;
(*
```

Argument definitions:

approval_status: the set of all instances of the **approval_status** entity.

Formal propositions:

WR1: The name of each **approval_status** shall be ‘passed’ or ‘rejected’.

5.2.4.4 external_source_product_definition_correlation

The **external_source_product_definition_correlation** rule ensures that each **external_source_product_definition_alias** has a **source_id** that is the same as the **id** of exactly one **product_definition** that is a Facility or a Material.

EXPRESS specification:

```
* )
RULE external_source_product_definition_correlation FOR
  (external_source_product_definition_alias, product_definition);
WHERE
  WR1: SIZEOF (QUERY (espda <* external_source_product_definition_alias |
    NOT (
      SIZEOF (QUERY (pd <* product_definition |
        (
          (pd.id = espda.source_id) AND
          (pd.frame_of_reference.name IN
            ['functional definition', 'functional occurrence',
            'physical definition', 'physical occurrence']))
        )) = 1
      ))) = 0;
END_RULE;
(*)
```

Argument definitions:

external_source_product_definition_alias: the set of all instances of the **external_source_product_definition_alias** entity data type.

product_definition: the set of all instances of the **product_definition** entity data type.

Formal propositions:

WR1: For every **external_source_product_definition_alias**, there shall be exactly one **product_definition** that has the same identifier, and is a Facility or a Material.

5.2.4.5 facility_and_material_life_cycle

The **facility_and_material_life_cycle** specifies that each instance of **product_definition** that is a facility or material shall have the life-cycle qualifier ‘intended’ or ‘actual’. Each instance of **product_definition** that is a typical facility or typical material shall have the life-cycle qualifier ‘actual’.

EXPRESS specification:

```
*)  
RULE facility_and_material_life_cycle FOR  
  (product_definition);  
WHERE  
  WR1: SIZEOF (QUERY (fac_mat <* QUERY (pd <* product_definition |  
    pd\product_definition.frame_of_reference.name IN  
    ['functional definition', 'functional occurrence',  
     'physical definition', 'physical occurrence']) |  
    NOT (fac_mat\product_definition.description IN  
      ['intended', 'actual'])  
   )) = 0;  
  WR2: SIZEOF (QUERY (fac_mat <* QUERY (pd <* product_definition |  
    pd\product_definition.frame_of_reference.name IN  
    ['functional definition', 'physical definition']) |  
    NOT (fac_mat\product_definition.description = 'actual')  
   )) = 0;  
END_RULE;  
(*
```

Argument definitions:

product_definition: the set of all instances of the **product_definition** entity.

Formal propositions:

WR1: The **description** of each **product_definition** that is a facility or a material shall be ‘intended’ or ‘actual’.

WR2: The **description** of each **product_definition** that is a typical facility or a typical material shall be ‘actual’.

5.2.4.6 plant_functional_layered_items

The **nexpplant_functional_layered_items** rule specifies that each instance of **presentation_layer_assignment** shall have as its assigned items only instances of **presentation_representation**.

EXPRESS specification:

```
* )
RULE plant_functional_layered_items FOR
(presentation_layer_assignment);
WHERE
WR1: SIZEOF (QUERY (pla <* presentation_layer_assignment |
NOT (
SIZEOF (QUERY (item <* pla.assigned_items |
'PLANT_FUNCTIONAL_DATA.PRESENTATION_REPRESENTATION'
IN TYPEOF (item)
)) = 0
))) = 0;
END_RULE;
(*
```

Argument definitions:

presentation_layer_assignment: the set of all instances of the **presentation_layer_assignment** entity.

Formal propositions:

WR1: The members of the **assigned_items** set of each **presentation_assignment** shall be **presentation_representation** instances.

5.2.4.7 product_definition_life_cycle

The **product_definition_life_cycle** rule specifies that each instance of **product_definition_relationship** that is a **provision_of_service**, **connection_of_facility**, **connection_of_material**, **usage_of_material_in_connection**, **collection_of_facility**, **collection_of_material**, **assembly_of_facility**, or **assembly_of_material** shall have the life-cycle qualifier ‘intended’ or ‘actual’.

EXPRESS specification:

```
* )
RULE product_definition_relationship_life_cycle
FOR (product_definition_relationship);
WHERE
WR1: SIZEOF (QUERY (pf_pdr <*
QUERY (pdr <* product_definition_relationship |
(SIZEOF (TYPEOF (pdr) *
[ 'PLANT_FUNCTIONAL_DATA.PROVISION_OF_SERVICE',
'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY',
'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL',
'PLANT_FUNCTIONAL_DATA.USAGE_OF_MATERIAL_IN_CONNECTION',
'PLANT_FUNCTIONAL_DATA.COLLECTION_OF_FACILITY',
'PLANT_FUNCTIONAL_DATA.COLLECTION_OF_MATERIAL',
'ASSEMBLY_OF_FACILITY',
'ASSEMBLY_OF_MATERIAL']) <> 0)) |
NOT (pf_pdr.description IN ['intended', 'actual']))
)) = 0;
END_RULE;
(*)
```

Argument definitions:

product_definition_relationship: the set of all instances of the **product_definition_relationship** entity.

Formal propositions:

WR1: The **description** of each **product_definition_relationship** that is a **provision_of_service**, **connection_of_facility**, **connection_of_material**, **usage_of_material_in_connection**, **collection_of_facility**, **collection_of_material**, **assembly_of_facility**, or **assembly_of_material** shall be ‘intended’ or ‘actual’.

5.2.5 Plant functional schema function definitions

5.2.5.1 plant_functional_organization_correlation

The **plant_functional_organization_correlation** boolean function returns TRUE if the **name** attribute of the **organization_role** entity type is coordinated with the entity type selected in the **items** of a **plant_functional_organization_assignment**.

EXAMPLE 259 – If the role for an **organization** is ‘identification scheme maintainer’, then all of the **items** in the set shall be **product_definition**, **product_category** or **product_definition_relationship**.

EXPRESS specification:

```

*)  

FUNCTION plant_functional_organization_correlation  

(e : plant_functional_organization_assignment ) : BOOLEAN;  

LOCAL  

    o_role : STRING;  

END_LOCAL;  

    o_role := e\organization_assignment.role.name;  

CASE o_role OF  

    'identification scheme maintainer', 'identification scheme user':  

        IF SIZEOF (e.items) <>  

        SIZEOF (QUERY (x <* e.items |  

        SIZEOF(['PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION',  

        'PLANT_FUNCTIONAL_DATA.PRODUCT_CATEGORY',  

        'PLANT_FUNCTIONAL_DATA.' +  

        'PRODUCT_DEFINITION_RELATIONSHIP'] *  

        TYPEOF (x)) = 1))  

        THEN RETURN(FALSE);  

        END_IF;  

    'designer', 'checker':  

        IF SIZEOF (e.items) <>  

        SIZEOF (QUERY (x <* e.items |  

        'PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE'  

        IN TYPEOF (x)))  

        THEN RETURN(FALSE);  

        END_IF;  

    'controller':  

        IF SIZEOF (e.items) <>  

        SIZEOF (QUERY (x <* e.items |  

        'PLANT_FUNCTIONAL_DATA.' +  

        'INFORMATION_CONTENT REPRESENTATION'  

        IN TYPEOF (x)))  

        THEN RETURN(FALSE);  

        END_IF;

```

```

'owner':
    IF SIZEOF (e.items) <>
    (SIZEOF (QUERY (x <* QUERY (y <* e.items |
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
    IN TYPEOF (y)) |
    x\product_definition.frame_of_reference.name IN
    ['physical definition', 'physical occurrence'])) +
    SIZEOF (QUERY (x <* e.items |
    'PLANT_FUNCTIONAL_DATA.' +
    'INFORMATION_CONTENT REPRESENTATION'
    IN TYPEOF (x)))
    THEN RETURN (FALSE);
    END_IF;

'custodian':
    IF SIZEOF (e.items) <>
    SIZEOF (QUERY (x <* QUERY (y <* e.items |
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
    IN TYPEOF (y)) |
    x\product_definition.frame_of_reference.name IN
    ['physical definition', 'physical occurrence']))
    THEN RETURN (FALSE);
    END_IF;

'operator':
    IF SIZEOF (e.items) <>
    SIZEOF (QUERY (x <* QUERY (y <* e.items |
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
    IN TYPEOF (y)) |
    x\product_definition.frame_of_reference.name IN
    ['functional definition',
    'functional occurrence']))
    THEN RETURN (FALSE);
    END_IF;

'context for hierarchy':
    IF SIZEOF (e.items) <>
    SIZEOF (QUERY (x <* e.items |
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION'
    IN TYPEOF (x)))
    THEN RETURN(FALSE);
    END_IF;

'context for identification':
    IF SIZEOF (e.items) <>
    SIZEOF (QUERY (x <* e.items |
    'PLANT_FUNCTIONAL_DATA.EXTERNAL_SOURCE'
    IN TYPEOF (x)))
    THEN RETURN(FALSE);
    END_IF;

OTHERWISE : RETURN(TRUE);
END_CASE;
RETURN (TRUE);
END_FUNCTION;
(*

```

Argument definitions:

e: the input **plant_functional_organization_assignment** to be checked.

5.2.5.2 plant_functional_person_correlation

The **plant_functional_person.correlation** boolean function returns TRUE if the **name** attribute of the **person_role** entity type is coordinated with the entity type selected in the **items** of a **plant_functional_person_assignment**.

EXPRESS specification:

```
*)  
FUNCTION plant_functional_person_correlation  
  (e : plant_functional_person_assignment ) : BOOLEAN;  
  LOCAL  
    p_role : STRING;  
  END_LOCAL;  
  p_role := e\person_assignment.role.name;  
  CASE p_role OF  
    'designer', 'checker':  
      IF SIZEOF (e.items) <>  
        SIZEOF (QUERY (x <* e.items |  
          'PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE'  
          IN TYPEOF (x)))  
      THEN RETURN(FALSE);  
      END_IF;  
  OTHERWISE : RETURN(TRUE);  
  END_CASE;  
  RETURN (TRUE);  
END_FUNCTION;  
(*
```

Argument definitions:

e: the input **plant_functional_person_assignment** to be checked.

EXPRESS specification:

```
*)  
END_SCHEMA;  
(*  
*)
```

6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods: ISO 10303-21, ISO 10303-22.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Information Conformance Statement (PICS) proforma lists the options or the combination of options that may be included in the implementation. The PICS proforma is provided in annex D.

ISO/CD 10303-221(E)

This part of ISO 10303 defines three categories of information that shall be supported by an implementation, as follows:

basic functional data: Within this category are:

- identification, classification, composition and connection of Facilities and Materials;
- transfer of material Activities performed by Facilities, e.g., stream design cases; and
- properties of Facilities, Materials and Activities.

NOTE 1 – The information in this category may be supported by application software concerned with engineering data sheets, and by intelligent P&ID systems.

schematic presentation: Within this category are:

- the geometric position and shape of symbolic and textual annotation; and
- the physical appearance of symbolic and textual annotation.

NOTES

2 – This information in this category on its own may be supported by ‘dumb’ graphics systems.

3 – In a Conformance Class that contains both the basic functional data and schematic presentation categories, support is required for the association between annotation and a thing, such as a Facility or Activity.

The combined basic functional data and schematic presentation information may be supported by ‘intelligent’ P&ID systems.

business information: Within this category are:

- class libraries and catalogues with or without designs that refer to them;
- information about the life cycle stage of design information;
- recording of changes to design information and the relationship between different designs;
- support for external sources of information and documents, including reference to data held in accordance with ISO 13584; and
- approval, ownership and other administrative information.

This category shall be combined with the basic functional data category.

NOTES

4 – This category, combined with the basic functional data and schematic presentation categories, completes the scope of this part of ISO 10303.

5 – The information in this category may be supported by engineering data management systems.

The Units of Functionality that are involved in each category are shown in table 30.

Table 30 – Units of functionality and categories of information

UoF	basic functional data	schematic presentation	business information
activity	x		
administration			x
approval			x
catalogue_of_standard_items			x
classification_of_plant_item	x		
composition_and_connection_of_plant_item	x		
data_inheritance			x
effect			x
hierarchical_decomposition;			x
identification	x		
information_and_document			x
involvement_constraint;			x
library_of_classes			x
life_cycle;			x
plant_item	x		
position_and_orientation	x		
process_material_and_substance	x		
property	x		
required_information;			x
schematic_appearance		x	
schematic_presentation_and_layout		x	
variance_and_derivation.			x

Conformance classes are defined by combinations of these categories of information, as shown in table 31.

An implementation of a Conformance Class shall recognise the specified instances of application objects that are defined in annex M and that are relevant to the Conformance Class.

The specified instances are divided into tables within annex M, and these tables are assigned to Units of Functionality by table 1.

The descriptions of the Conformance Classes are as follows:

class 1 - basic functional data: Support for all information requirements in the basic functional data category is required.

Table 31 – Conformance classes and categories of information

Conformance class	basic functional data	schematic presentation	business information
class 1	x		
class 2		x	
class 3	x	x	
class 4	x		x
class 5	x	x	x

NOTES

6 – This Conformance Class may be used to specify exchange between engineering data sheet applications.

7 – The scope of the engineering information that may be exchanged by this Conformance Class is identical to the scope of the engineering information that may be exchanged by the Functional Data Conformance Class of ISO 10303 part 227.

class 2 - schematic presentation: Support for all information requirements in the schematic presentation category is required. No basic functional data shall be included.

NOTE 8 – This Conformance Class may be used to specify exchange between graphics applications that create ‘dumb’ P&IDs without associations between the annotation and functional data.

class 3 - basic functional data and schematic presentation: Support for information in the basic functional data and schematic presentation categories is required.

NOTE 9 – This Conformance Class may be used to specify exchange between graphics applications that create ‘intelligent’ P&IDs with associations between the annotation and functional data.

class 4 - basic functional data and business information: Support for information in the basic functional data and business information categories is required.

NOTE 10 – This Conformance Class may be used to specify exchange between advanced engineering data sheet applications that also have an engineering data management capability and can support bills of materials, version control and audit trails.

class 5 - basic functional data, schematic presentation and business information: Support for information in the basic functional data, schematic presentation and business information categories is required.

NOTE 11 – This Conformance Class may be used to specify exchange between advanced engineering data sheet an P&ID applications that also have an engineering data management capability.

This Conformance Class may be used to specify exchange between process plant data repository systems that:

- receive and merge data from engineering data sheet and P&ID applications; and
- provide engineering data management capabilities such as approval and version control.

External reference to data held in accordance with ISO 13584 shall be supported by Conformance Classes 4 and 5.

The AIM elements that shall be supported by each Conformance Class are shown in table 32.

The tables of standard data that shall be supported by each Conformance Class are shown in table 33.

Table 32 – Conformance class elements

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
action				X	X
action_assignment				X	X
action_composition				X	X
action_method	X		X	X	X
action_method_composition				X	X
action_method_relationship				X	X
action_method_sequence				X	X
action_property	X		X	X	X
action_property_relationship				X	X
action_property_representation	X		X	X	X
action_relationship				X	X
action_resource	X		X	X	X
action_resource_type	X		X	X	X
action_role	X		X	X	X
action_sequence				X	X
address				X	X
alternate_connection_identification	X		X	X	X
amount_of_substance_measure_with_unit	X		X	X	X
amount_of_substance_unit	X		X	X	X
annotation_curve_occurrence		X	X		X
annotation_fill_area		X	X		X
annotation_fill_area_occurrence		X	X		X
annotation_occurrence		X	X		X
annotation_occurrence_relationship		X	X		X
annotation_symbol		X	X		X
annotation_symbol_occurrence		X	X		X
annotation_text		X	X		X
annotation_text_occurrence		X	X		X
annotation_text_with_extent		X	X		X
application_context	X	X	X	X	X
application_context_element	X	X	X	X	X
application_protocol_definition	X	X	X	X	X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
approval				X	X
approval_assignment				X	X
approval_role				X	X
approval_status				X	X
area_in_set		X	X		X
area_measure_with_unit	X		X	X	X
area_unit	X		X	X	X
assembly_component_usage	X		X	X	X
assembly_component_usage_substitute				X	X
assembly_of_facility	X		X	X	X
assembly_of_material	X		X	X	X
axis2_placement_2d		X	X		X
b_spline_curve		X	X		X
b_spline_curve_with_knots		X	X		X
bezier_curve		X	X		X
binary_object_representation				X	X
bounded_curve		X	X		X
cartesian_point		X	X		X
characterized_object	X		X	X	X
circle		X	X		X
class_of_activity	X		X	X	X
class_of_annotation_element		X	X		X
class_of_annotation_element_assembly_constraint					X
class_of_annotation_element_connection_constraint					X
class_of_annotation_element_presentation_of_facility_constraint_assignment					X
class_of_annotation_element_presentation_of_material_constraint_assignment					X
class_of_facility	X		X	X	X
class_of_facility_assembly_constraint				X	X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
class_of_facility_connection_constraint				X	X
class_of_information_content				X	X
class_of_information_content_composition_constraint				X	X
class_of_involvement	X		X	X	X
class_of_material	X		X	X	X
class_of_material_assembly_constraint				X	X
class_of_material_connection_constraint				X	X
class_of_property	X		X	X	X
class_of_substance	X		X	X	X
classification_of_class_of_annotation_element					X
classification_of_class_of_facility				X	X
classification_of_class_of_material				X	X
classification_of_facility	X		X	X	X
classification_of_material	X		X	X	X
collection_of_facility	X		X	X	X
collection_of_material	X		X	X	X
colour		X	X		X
colour_rgb		X	X		X
colour_specification		X	X		X
composite_curve		X	X		X
composite_curve_segment		X	X		X
composite_text		X	X		X
composite_text_with_associated_curves		X	X		X
composite_text_with_blanking_box		X	X		X
composite_text_with_extent		X	X		X
conic		X	X		X
connection_of_facility	X		X	X	X
connection_of_material	X		X	X	X
connection_shape_aspect	X		X	X	X
connector_feature_annotation_occurrence		X	X		X
context_dependent_invisibility		X	X		X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
context_dependent_unit	X	X	X	X	X
conversion_based_unit	X	X	X	X	X
coordinated_universal_time_offset				X	X
curve		X	X		X
curve_style		X	X		X
curve_style_font		X	X		X
curve_style_font_pattern		X	X		X
date				X	X
date_and_time				X	X
dated_effectivity				X	X
defined_symbol		X	X		X
derived_unit	X	X	X	X	X
derived_unit_element	X	X	X	X	X
descriptive_representation_item	X		X	X	X
dimensional_exponents	X	X	X	X	X
direction		X	X		X
direction_range_for_connector_feature		X	X		X
direction_range_representation		X	X		X
document				X	X
document_reference				X	X
document_role				X	X
document_relationship				X	X
document_type				X	X
draughting_callout		X	X		X
draughting_callout_relationship		X	X		X
draughting_title		X	X		X
drawing_definition		X	X		X
drawing_revision		X	X		X
drawing_sheet_revision		X	X		X
drawing_sheet_revision_usage		X	X		X
effectivity				X	X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
effectivity_assignment				x	x
effectivity_relationship				x	x
effectivity_role				x	x
electric_current_measure_with_unit	x		x	x	x
electric_current_unit	x		x	x	x
ellipse		x	x		x
expression_conversion_based_unit	x		x	x	x
expression_definition	x		x	x	x
external_identification_assignment				x	x
external_referent_assignment				x	x
external_referent_role				x	x
external_source				x	x
external_source_product_definition_alias				x	x
externally_defined_class_of_activity				x	x
externally_defined_class_of_annotation_element		x	x		x
externally_defined_class_of_annotation_element_assembly_constraint					x
externally_defined_class_of_annotation_element_connection_constraint					x
externally_defined_class_of_facility	x		x	x	x
externally_defined_class_of_facility_assembly_constraint				x	x
externally_defined_class_of_facility_connection_constraint				x	x
externally_defined_class_of_information_content				x	x
externally_defined_class_of_involvement				x	x
externally_defined_class_of_material	x		x	x	x
externally_defined_class_of_material_assembly_constraint				x	x
externally_defined_class_of_material_connection_constraint				x	x
externally_defined_class_of_property	x		x	x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
externally_defined_classification_of_class_of_annotation_element					x
externally_defined_classification_of_class_of_facility				x	x
externally_defined_classification_of_class_of_material				x	x
externally_defined_curve_font		x	x		x
externally_defined_hatch_style		x	x		x
externally_defined_involvement_in_activity_class_constraint				x	x
externally_defined_item	x	x	x	x	x
externally_defined_material_or_facility				x	x
externally_defined_recognized_provision_of_service_according_to_class				x	x
externally_defined_representation_item				x	x
externally_defined_symbol		x	x		x
externally_defined_text_font		x	x		x
externally_defined_tile_style		x	x		x
facility_port	x		x	x	x
fill_area_style	x		x	x	x
fill_area_style.colour		x	x		x
fill_area_style.hatching		x	x		x
fill_area_style.tile_symbol_with_style		x	x		x
fill_area_style.tiles		x	x		x
geometric_representation_context		x	x		x
geometric_representation_item		x	x		x
global_unit_assigned_context	x	x	x	x	x
graphical_transformation		x	x		x
group	x	x	x	x	x
group_assignment	x	x	x	x	x
group_relationship	x	x	x	x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
hyperbola		X	X		X
identification_assignment	X	X	X	X	X
identification_role	X	X	X	X	X
information_content_representation				X	X
inheritance_effectivity				X	X
invisibility		X	X		X
involvement_in_activity_class_constraint				X	X
involvement_in_activity_class_constraint_group				X	X
item_defined_transformation		X	X		X
leader_curve		X	X		X
leader_directed_callout		X	X		X
leader_terminator		X	X		X
length_measure_with_unit	X	X	X	X	X
length_unit	X	X	X	X	X
library_assignment				X	X
library_context				X	X
line		X	X		X
local_time				X	X
luminous_intensity_measure_with_unit	X		X	X	X
luminous_intensity_unit	X		X	X	X
mapped_item		X	X		X
mass_measure_with_unit	X		X	X	X
mass_unit	X		X	X	X
measure_representation_item	X	X	X	X	X
measure_with_unit	X	X	X	X	X
name_assignment				X	X
name_role				X	X
named_unit	X	X	X	X	X
next_assembly_usage_occurrence	X		X	X	X
offset_curve_2d		X	X		X
one_direction_repeat_factor		X	X		X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
organization				x	x
organization_assignment				x	x
organization_relationship				x	x
organization_role				x	x
organizational_address				x	x
orientation_of_material				x	x
orientation_of_resource_for_facility				x	x
page_connector		x	x		x
parabola		x	x		x
person				x	x
person_and_organization				x	x
person_assignment				x	x
person_role				x	x
personal_address				x	x
phase_of_material	x		x	x	x
placed_effectivity				x	x
placement		x	x		x
planar_box		x	x		x
planar_extent		x	x		x
plane_angle_measure_with_unit	x	x	x	x	x
plane_angle_unit	x	x	x	x	x
plant_functional_action_identification_context_assignment				x	x
plant_functional_activity_input_information_content_class_constraint_assignment				x	x
plant_functional_activity_input_information_content_constraint_assignment				x	x
plant_functional_activity_input_property_class_constraint_assignment				x	x
plant_functional_activity_input_property_constraint_assignment				x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
plant_functional_activity_output_information_-content_class_constraint_assignment				x	x
plant_functional_activity_output_information_-content_constraint_assignment				x	x
plant_functional_activity_output_property_class_-constraint_assignment				x	x
plant_functional_activity_output_property_-constraint_assignment				x	x
plant_functional_activity_performer				x	x
plant_functional_approval_assignment				x	x
plant_functional_approval_effectivity_assignment				x	x
plant_functional_assessed_object_activity_-assignment				x	x
plant_functional_assessment_purpose_activity_-assignment				x	x
plant_functional_assessment_result_activity_-assignment				x	x
plant_functional_class_of_activity_assignment	x	x	x	x	x
plant_functional_class_of_annotation_element_-assignment		x	x		x
plant_functional_class_of_facility_library_-assignment				x	x
plant_functional_class_of_information_content_-assignment				x	x
plant_functional_class_of_information_content_-library_assignment				x	x
plant_functional_class_of_information_held_by_-information_carrier_assignment				x	x
plant_functional_class_of_involvement_assignment	x		x	x	x
plant_functional_class_of_material_library_-assignment				x	x
plant_functional_class_of_object_description_-constraint_assignment				x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
plant_functional_class_of_property_library_assignment				x	x
plant_functional_context_for_hierarchy_action_assignment				x	x
plant_functional_context_for_hierarchy_group_assignment				x	x
plant_functional_context_for_hierarchy_organization_assignment				x	x
plant_functional_data_record_name_assignment				x	x
plant_functional_design_reference_activity_assignment				x	x
plant_functional_design_result_activity_assignment				x	x
plant_functional_effectivity_assignment				x	x
plant_functional_enumerated_property_in_class_of_property_assignment	x		x	x	x
plant_functional_group_identification_context_assignment				x	x
plant_functional_identification_assignment				x	x
plant_functional_information_carrier_definition_assignment				x	x
plant_functional_information_carrier_description_assignment				x	x
plant_functional_information_carrier_reference_assignment				x	x
plant_functional_information_content_definition_assignment				x	x
plant_functional_information_content_description_assignment				x	x
plant_functional_information_content_reference_assignment				x	x
plant_functional_inheritance_exclusion_assignment				x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
plant_functional_inheritance_inclusion_assignment				x	x
plant_functional_involvement_constraint_assignment				x	x
plant_functional_involvement_of_object_in_activity_class_constraint_assignment				x	x
plant_functional_numeric_operator	x		x	x	x
plant_functional_organization_assignment				x	x
plant_functional_person_assignment				x	x
plant_functional_presented_item		x	x		x
plant_functional_presented_item_with_association		x	x		x
plant_functional_property_classification_assignment	x		x	x	x
plant_functional_recognized_possession_of_property_assignment				x	x
plant_functional_symbol_library_assignment					x
plant_functional_transfer_material_destination_activity_assignment				x	x
plant_functional_transfer_material_source_activity_assignment				x	x
plant_functional_transferred_material_activity_assignment				x	x
plant_functional_transform_material_input_activity_assignment				x	x
plant_functional_transform_material_output_activity_assignment				x	x
plant_functional_typical_facility_catalogue_assignment				x	x
plant_functional_typical_material_catalogue_assignment				x	x
point		x	x		x
point_in_space_of_material				x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
point_in_space_of_resource_for_facility				X	X
point_on_curve		X	X		X
polyline		X	X		X
possession_of_facility_port	X		X	X	X
possession_of_feature_connector	X		X	X	X
pre_defined_colour		X	X		X
pre_defined_curve_font		X	X		X
pre_defined_item	X	X	X	X	X
pre_defined_symbol		X	X		X
pre_defined_text_font		X	X		X
presentation_area		X	X		X
presentation_layer_assignment		X	X		X
presentation_layer_usage		X	X		X
presentation_representation		X	X		X
presentation_representation_relationship		X	X		X
presentation_set		X	X		X
presentation_size		X	X		X
presentation_style_assignment		X	X		X
presentation_view		X	X		X
presentation_view_with_clipping_box		X	X		X
presentation_with_association		X	X		X
presented_item		X	X		X
presented_item_representation		X	X		X
process_or_process_relationship_effectivity				X	X
process_product_association	X		X	X	X
product	X	X	X	X	X
product_category	X	X	X	X	X
product_category_relationship				X	X
product_context	X	X	X	X	X
product_definition	X	X	X	X	X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
product_definition_alternative				x	x
product_definition_context	x	x	x	x	x
product_definition_derivation				x	x
product_definition_effectivity				x	x
product_definition_formation	x	x	x	x	x
product_definition_relationship	x		x	x	x
product_definition_shape				x	x
product_definition_usage	x		x	x	x
product_definition_version				x	x
product_definition_with_associated_documents				x	x
product_related_product_category	x		x	x	x
projection_curve		x	x		x
projection_directed_callout		x	x		x
property_by_member	x		x	x	x
property_definition	x		x	x	x
property_definition_alternative				x	x
property_definition_derivation				x	x
property_definition_relationship				x	x
property_definition_representation	x		x	x	x
property_definition_version				x	x
provision_of_service	x		x	x	x
qualified_representation_item	x		x	x	x
quasi_uniform_curve		x	x		x
ratio_measure_with_unit	x	x	x	x	x
ratio_unit	x	x	x	x	x
rational_b_spline_curve		x	x		x
realization_of_intended_activity_by_actual				x	x
realization_of_intended_facility_or_material_by_actual				x	x

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
recognized_class_of_resource				X	X
recognized_class_of_service				X	X
recognized_provision_of_service_according_to_class				X	X
reference_between_page_connector		X	X		X
representation	X	X	X	X	X
representation_alternative				X	X
representation_context	X	X	X	X	X
representation_derivation				X	X
representation_item	X	X	X	X	X
representation_map		X	X		X
representation_relationship		X	X		X
representation_relationship_with_transformation		X	X		X
representation_version				X	X
serial_action_method				X	X
shape_aspect	X		X	X	X
shape_aspect_relationship	X		X	X	X
si_unit	X	X	X	X	X
solid_angle_measure_with_unit	X		X	X	X
solid_angle_unit	X		X	X	X
specified_higher_usage_occurrence				X	X
standard_class_of_activity	X		X	X	X
standard_class_of_annotation_element		X	X		X
standard_class_of_facility	X		X	X	X
standard_class_of_information_content				X	X
standard_class_of_involvement	X		X	X	X
standard_class_of_material	X		X	X	X
standard_class_of_property	X		X	X	X
standard_classification_of_class_of_facility				X	X
standard_classification_of_class_of_material				X	X
standard_involvement_in_activity_class_constraint				X	X

Table 32 – Conformance class elements (continued)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
styled_item		X	X		X
symbol_colour		X	X		X
symbol_representation		X	X		X
symbol_representation_map		X	X		X
symbol_style		X	X		X
symbol_target		X	X		X
terminator_symbol		X	X		X
text_literal		X	X		X
text_literal_with_associated_curves		X	X		X
text_literal_with_blanking_box		X	X		X
text_literal_with_delineation		X	X		X
text_literal_with_extent		X	X		X
text_style		X	X		X
text_style_for_defined_font		X	X		X
text_style_with_box_characteristics		X	X		X
text_style_with_mirror		X	X		X
thermodynamic_temperature_measure_with_unit	X		X	X	X
thermodynamic_temperature_unit	X		X	X	X
time_measure_with_unit	X		X	X	X
time_unit	X		X	X	X
topological_sequence_of_facility	X		X	X	X
trimmed_curve		X	X		X
two_direction_repeat_factor		X	X		X
type_qualifier	X		X	X	X
uniform_curve		X	X		X
usage_of_facility_in_connection	X		X	X	X
usage_of_feature_in_connection	X		X	X	X
usage_of_material_in_connection	X		X	X	X
vector		X	X		X
view_dependent_invisibility		X	X		X

Table 32 – Conformance class elements (concluded)

AIM element	classes				
	class 1	class 2	class 3	class 4	class 5
volume_measure_with_unit	X		X	X	X
volume_unit	X		X	X	X

Table 33 – Conformance class standard instances

table of standard data	classes				
	class 1	class 2	class 3	class 4	class 5
Class_of_activity for design	x		x	x	x
Class_of_activity for processes	x		x	x	x
Class_of_annotation_element		x	x		x
Class_of_facility for Connector_of_facility	x		x	x	x
Class_of_facility for generic classification	x		x	x	x
Class_of_facility for heat transfer	x		x	x	x
Class_of_facility for instrumentation and control	x		x	x	x
Class_of_facility for piping and insulation	x		x	x	x
Class_of_facility for plants and systems	x		x	x	x
Class_of_facility for rotating and reciprocating equipment	x		x	x	x
Class_of_facility for valves	x		x	x	x
Class_of_facility for vessels	x		x	x	x
Class_of_facility for Logical_information_carrier				x	x
Class_of_information_content for identification	x		x	x	x
Class_of_information_content for design documentation				x	x
Class_of_information_content for natural language				x	x
Class_of_involvement	x		x	x	x
Class_of_material for generic classification	x		x	x	x
Class_of_material for heat transfer	x		x	x	x
Class_of_material for heat transfer equipment components	x		x	x	x
Class_of_material for instrumentation and control	x		x	x	x
Class_of_material for instrumentation and control components	x		x	x	x
Class_of_material for piping and insulation	x		x	x	x
Class_of_material for plants and systems	x		x	x	x

Table 33 – Conformance class standard instances (concluded)

table of standard data	classes				
	class 1	class 2	class 3	class 4	class 5
Class_of_material for rotating and reciprocating equipment	X		X	X	X
Class_of_material for valves	X		X	X	X
Class_of_material for valve components	X		X	X	X
Class_of_material for vessels	X		X	X	X
Class_of_material for vessel components	X		X	X	X
Class_of_material for Physical_information_carrier				X	X
Class_of_property for composition	X		X	X	X
Class_of_property for Material and Activity	X		X	X	X
Class_of_property for Physical_information_carrier				X	X
Class_of_substance for Phase	X		X	X	X
Class_of_substance for Process_material	X		X	X	X
Classification_of_class_of_facility				X	X
Classification_of_class_of_material				X	X
Property enumerations for colour		X	X		X
Recognized_involvement_for_activity_according_to_class for design				X	X
Recognized_involvement_for_activity_according_to_class for processes				X	X

Annex A
(normative)

AIM EXPRESS expanded listing

The following EXPRESS is the expanded form of the short form schema given in 5.2. In the event of any discrepancy between the short form and this expanded listing, the expanded listing shall be used.

```

SCHEMA plant_functional_data;

TYPE activity_performer_item = SELECT
  (person,
   organization,
   product_definition);
END_TYPE; -- activity_performer_item

TYPE ahead_or_behind = ENUMERATION OF
  (ahead,
   behind);
END_TYPE; -- ahead_or_behind

TYPE amount_of_substance_measure = REAL;
END_TYPE; -- amount_of_substance_measure

TYPE annotation_element_item = SELECT
  (annotation_occurrence,
   drawing_revision,
   presentation_layer_assignment,
   presentation_representation,
   symbol_representation);
END_TYPE; -- annotation_element_item

TYPE approval_effectivity_item = SELECT
  (plant_functional_approval_assignment);
END_TYPE; -- approval_effectivity_item

TYPE approval_item = SELECT
  (action,
   action_assignment,
   action_method,
   action_property,
   action_relationship,
   annotation_fill_area,
   annotation_occurrence,
   annotation_occurrence_relationship,
   annotation_symbol,
   annotation_text,
   approval_status,
   assembly_component_usage_substitute,

```

```
axis2_placement_2d,
class_of_facility,
class_of_facility_assembly_constraint,
class_of_facility_connection_constraint,
class_of_material,
class_of_material_assembly_constraint,
class_of_material_connection_constraint,
classification_of_class_of_facility,
classification_of_class_of_material,
classification_of_facility,
classification_of_material,
colour_rgb,
composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
```

```
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE; -- approval_item

TYPE area_measure = REAL;
END_TYPE; -- area_measure

TYPE area_or_view = SELECT
(presentation_area,
 presentation_view);
END_TYPE; -- area_or_view

TYPE assessment_purpose_item = SELECT
(action,
 action_method,
 class_of_activity);
END_TYPE; -- assessment_purpose_item

TYPE assessment_result_item = SELECT
(effectivity);
END_TYPE; -- assessment_result_item

TYPE attribute_type = SELECT
(label,
 text);
END_TYPE; -- attribute_type

TYPE axis2_placement = SELECT
(axis2_placement_2d);
END_TYPE; -- axis2_placement
```

```

TYPE b_spline_curve_form = ENUMERATION OF
  (polyline_form,
   circular_arc,
   elliptic_arc,
   parabolic_arc,
   hyperbolic_arc,
   unspecified);
END_TYPE; -- b_spline_curve_form

TYPE box_characteristic_select = SELECT
  (box_height,
   box_width,
   box_slant_angle,
   box_rotate_angle);
END_TYPE; -- box_characteristic_select

TYPE box_height = positive_ratio_measure;
END_TYPE; -- box_height

TYPE box_rotate_angle = plane_angle_measure;
END_TYPE; -- box_rotate_angle

TYPE box_slant_angle = plane_angle_measure;
END_TYPE; -- box_slant_angle

TYPE box_width = positive_ratio_measure;
END_TYPE; -- box_width

TYPE character_spacing_select = SELECT
  (length_measure,
   ratio_measure,
   measure_with_unit,
   descriptive_measure);
END_TYPE; -- character_spacing_select

TYPE character_style_select = SELECT
  (text_style_for_defined_font);
END_TYPE; -- character_style_select

TYPE characterized_action_definition = SELECT
  (action,
   action_method,
   action_method_relationship,
   action_relationship);
END_TYPE; -- characterized_action_definition

TYPE characterized_definition = SELECT
  (characterized_object,
   characterized_product_definition,
   shape_definition);
END_TYPE; -- characterized_definition

```

```
TYPE characterized_product_definition = SELECT
  (product_definition,
   product_definition_relationship);
END_TYPE; -- characterized_product_definition

TYPE characterized_resource_definition = SELECT
  (action_resource);
END_TYPE; -- characterized_resource_definition

TYPE class_of_activity_item = SELECT
  (action,
   action_method);
END_TYPE; -- class_of_activity_item

TYPE class_of_annotation_element_library_item = SELECT
  (class_of_annotation_element);
END_TYPE; -- class_of_annotation_element_library_item

TYPE class_of_facility_library_item = SELECT
  (class_of_facility);
END_TYPE; -- class_of_facility_library_item

TYPE class_of_information_content_library_item = SELECT
  (class_of_information_content);
END_TYPE; -- class_of_information_content_library_item

TYPE class_of_involvement_item = SELECT
  (plant_functional_activity_performer_assignment,
   plant_functional_assessed_object_activity_assignment,
   plant_functional_assessment_purpose_activity_assignment,
   plant_functional_assessment_result_activity_assignment,
   plant_functional_design_reference_activity_assignment,
   plant_functional_design_result_activity_assignment,
   plant_functional_transfer_material_destination_activity_assignment,
   plant_functional_transfer_material_source_activity_assignment,
   plant_functional_transferred_material_activity_assignment,
   plant_functional_transform_material_input_activity_assignment,
   plant_functional_transform_material_output_activity_assignment);
END_TYPE; -- class_of_involvement_item

TYPE class_of_material_library_item = SELECT
  (class_of_material);
END_TYPE; -- class_of_material_library_item

TYPE class_of_property_item = SELECT
  (action_property,
   property_definition);
END_TYPE; -- class_of_property_item
```

```

TYPE class_of_property_library_item = SELECT
  (class_of_property);
END_TYPE; -- class_of_property_library_item

TYPE context_dependent_measure = REAL;
END_TYPE; -- context_dependent_measure

TYPE count_measure = NUMBER;
END_TYPE; -- count_measure

TYPE curve_font_or_scaled_curve_font_select = SELECT
  (curve_style_font_select);
END_TYPE; -- curve_font_or_scaled_curve_font_select

TYPE curve_or_annotation_curve_occurrence = SELECT
  (curve,
   annotation_curve_occurrence);
END_TYPE; -- curve_or_annotation_curve_occurrence

TYPE curve_or_render = SELECT
  (curve_style);
END_TYPE; -- curve_or_render

TYPE curve_style_font_select = SELECT
  (curve_style_font,
   pre_defined_curve_font,
   externally_defined_curve_font);
END_TYPE; -- curve_style_font_select

TYPE date_time_select = SELECT
  (date,
   local_time,
   date_and_time);
END_TYPE; -- date_time_select

TYPE defined_symbol_select = SELECT
  (pre_defined_symbol,
   externally_defined_symbol);
END_TYPE; -- defined_symbol_select

TYPE described_item = SELECT
  (action,
   action_assignment,
   action_method,
   action_property,
   action_relationship,
   annotation_fill_area,
   annotation_occurrence,
   annotation_occurrence_relationship,
   annotation_symbol,

```

```
annotation_text,  
approval_status,  
assembly_component_usage_substitute,  
class_of_activity,  
class_of_facility,  
class_of_facility_assembly_constraint,  
class_of_facility_connection_constraint,  
class_of_material,  
class_of_material_assembly_constraint,  
class_of_material_connection_constraint,  
classification_of_class_of_facility,  
classification_of_class_of_material,  
classification_of_facility,  
classification_of_material,  
colour_rgb,  
composite_text,  
connection_of_facility,  
connection_of_material,  
curve,  
date_and_time,  
defined_symbol,  
descriptive_representation_item,  
direction_range_for_connector_feature,  
document,  
document_reference,  
drawing_revision,  
drawing_sheet_revision,  
drawing_sheet_revision_usage,  
effectivity,  
effectivity_assignment,  
fill_area_style_hatching,  
fill_area_style_tiles,  
group,  
group_assignment,  
group_relationship,  
inheritance_effectivity,  
library_assignment,  
library_context,  
measure_representation_item,  
organization,  
organization_relationship,  
person,  
person_and_organization,  
axis2_placement_2d,  
planar_extent,  
point,
```

```

positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE; -- described_item

TYPE descriptive_measure = STRING;
END_TYPE; -- descriptive_measure

TYPE design_item = SELECT
  (action,
   action_assignment,
   action_method,
   action_property,
   action_relationship,
   annotation_fill_area,
   annotation_occurrence,
   annotation_occurrence_relationship,
   annotation_symbol,
   annotation_text,
   approval_status,
   assembly_component_usage_substitute,
   axis2_placement_2d,
   class_of_facility,
   class_of_facility_assembly_constraint,

```

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```
class_of_facility_connection_constraint,
class_of_material,
class_of_material_assembly_constraint,
class_of_material_connection_constraint,
classification_of_class_of_facility,
classification_of_class_of_material,
classification_of_facility,
classification_of_material,
colour_rgb,
composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
```

```

product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE; -- design_item

TYPE dimension_count = INTEGER;
WHERE
  wr1: SELF > 0;
END_TYPE; -- dimension_count

TYPE draughting_callout_element = SELECT
  (annotation_text_occurrence,
   annotation_symbol_occurrence,
   annotation_curve_occurrence);
END_TYPE; -- draughting_callout_element

TYPE draughting_titled_item = SELECT
  (drawing_revision,
   drawing_sheet_revision);
END_TYPE; -- draughting_titled_item

TYPE effectivity_item = SELECT
  (action,
   action_method,
   assembly_of_facility,
   assembly_of_material,
   classification_of_class_of_facility,
   classification_of_class_of_material,
   classification_of_facility,
   classification_of_material,
   collection_of_facility,
   collection_of_material,

```

```
connection_of_facility,
connection_of_material,
effectivity,
plant_functional_class_of_annotation_element_assignment,
plant_functional_class_of_information_content_assignment,
plant_functional_class_of_involvement_assignment,
plant_functional_property_classification_assignment,
plant_functional_recognized_possession_of_property_assignment,
product_definition);
END_TYPE; -- effectivity_item

TYPE electric_current_measure = REAL;
END_TYPE; -- electric_current_measure

TYPE expression_operand = SELECT
(measure_with_unit,
expression_definition);
END_TYPE; -- expression_operand

TYPE fill_area_style_tile_shape_select = SELECT
(fill_area_style_tile_symbol_with_style);
END_TYPE; -- fill_area_style_tile_shape_select

TYPE fill_style_select = SELECT
(fill_area_style_colour,
externally_defined_tile_style,
fill_area_style_tiles,
externally_defined_hatch_style,
fill_area_style_hatching);
END_TYPE; -- fill_style_select

TYPE font_select = SELECT
(pre_defined_text_font,
externally_defined_text_font);
END_TYPE; -- font_select

TYPE hiding_or_blanking_select = SELECT
(presentation_area,
presentation_view,
annotation_fill_area);
END_TYPE; -- hiding_or_blanking_select

TYPE hierarchy_context_item = SELECT
(product_definition);
END_TYPE; -- hierarchy_context_item

TYPE hour_in_day = INTEGER;
WHERE
wr1: (0 <= SELF) AND (SELF < 24);
END_TYPE; -- hour_in_day
```

```

TYPE identification_context_item = SELECT
  (external_source);
END_TYPE; -- identification_context_item

TYPE identified_item = SELECT
  (action,
   action_method,
   class_of_activity,
   effectivity,
   plant_functional_approval_assignment,
   class_of_information_content,
   class_of_facility,
   class_of_involvement,
   class_of_material,
   class_of_material,
   connection_of_facility,
   connection_of_material,
   product_definition,
   shape_aspect,
   specified_higher_usage_occurrence,
   information_content_representation,
   organization,
   person,
   property_definition,
   provision_of_service);
END_TYPE; -- identified_item

TYPE identifier = STRING;
END_TYPE; -- identifier

TYPE information_carrier_item = SELECT
  (product_definition);
END_TYPE; -- information_carrier_item

TYPE information_content_item = SELECT
  (representation_context);
END_TYPE; -- information_content_item

TYPE inherited_item = SELECT
  (action_assignment,
   action_method_relationship,
   action_relationship,
   approval_assignment,
   document_reference,
   effectivity_assignment,
   group_assignment,
   library_assignment,
   name_assignment,

```

```
organization_assignment,
person_assignment,
product_definition_relationship,
product_related_product_category,
property_definition_relationship,
representation_relationship,
shape_aspect_relationship);
END_TYPE; -- inherited_item

TYPE input_output_information_content_description_item = SELECT
(plant_functional_class_of_object_description_constraint_assignment);
END_TYPE; -- input_output_information_content_description_item

TYPE input_output_property_possession_item = SELECT
(plant_functional_recognized_possession_of_property_assignment);
END_TYPE; -- input_output_property_possession_item

TYPE invisibility_context = SELECT
(presentation_layer_usage,
presentation_representation,
presentation_set);
END_TYPE; -- invisibility_context

TYPE invisible_item = SELECT
(styled_item,
presentation_layer_assignment,
presentation_representation);
END_TYPE; -- invisible_item

TYPE involved_class_item = SELECT
(class_of_facility,
class_of_material);
END_TYPE; -- involved_class_item

TYPE item_for_presentation = SELECT
(action,
action_method,
connection_of_facility,
connection_of_material,
effectivity,
information_content_representation,
product_definition,
shape_aspect);
END_TYPE; -- item_for_presentation

TYPE knot_type = ENUMERATION OF
(uniform_knots,
unspecified,
quasi_uniform_knots,
```

```

    piecewise_bezier_knots);
END_TYPE; -- knot_type

TYPE label = STRING;
END_TYPE; -- label

TYPE layered_item = SELECT
  (presentation_representation,
   representation_item);
END_TYPE; -- layered_item

TYPE length_measure = REAL;
END_TYPE; -- length_measure

TYPE luminous_intensity_measure = REAL;
END_TYPE; -- luminous_intensity_measure

TYPE mass_measure = REAL;
END_TYPE; -- mass_measure

TYPE measure_value = SELECT
  (length_measure,
   mass_measure,
   time_measure,
   electric_current_measure,
   thermodynamic_temperature_measure,
   amount_of_substance_measure,
   luminous_intensity_measure,
   plane_angle_measure,
   solid_angle_measure,
   area_measure,
   volume_measure,
   ratio_measure,
   parameter_value,
   numeric_measure,
   context_dependent_measure,
   descriptive_measure,
   positive_length_measure,
   positive_plane_angle_measure,
   positive_ratio_measure,
   count_measure);
END_TYPE; -- measure_value

TYPE minute_in_hour = INTEGER;
WHERE
  wr1: (0 <= SELF) AND (SELF <= 59);
END_TYPE; -- minute_in_hour

TYPE named_item = SELECT

```

```
(action,
action_assignment,
action_method,
action_property,
action_relationship,
annotation_fill_area,
annotation_occurrence,
annotation_occurrence_relationship,
annotation_symbol,
annotation_text,
approval_status,
assembly_component_usage_substitute,
axis2_placement_2d,
class_of_facility,
class_of_facility_assembly_constraint,
class_of_facility_connection_constraint,
class_of_material,
class_of_material_assembly_constraint,
class_of_material_connection_constraint,
classification_of_class_of_facility,
classification_of_class_of_material,
classification_of_facility,
classification_of_material,
colour_rgb,
composite_text,
connection_of_facility,
connection_of_material,
curve,
date_and_time,
defined_symbol,
descriptive_representation_item,
direction_range_for_connector_feature,
document,
document_reference,
drawing_revision,
drawing_sheet_revision,
drawing_sheet_revision_usage,
effectivity,
effectivity_assignment,
fill_area_style_hatching,
fill_area_style_tiles,
group,
group_assignment,
group_relationship,
inheritance_effectivity,
library_assignment,
```

```

library_context,
measure_representation_item,
organization,
organization_relationship,
person,
person_and_organization,
planar_extent,
point,
positive_ratio_measure,
presentation_layer_assignment,
presentation_layer_usage,
presentation_representation_relationship,
presented_item_representation,
product_definition,
product_definition_relationship,
product_definition_shape,
property_definition,
property_definition_alternative,
property_definition_derivation,
property_definition_representation,
property_definition_version,
recognized_class_of_resource,
recognized_class_of_service,
recognized_provision_of_service_according_to_class,
reference_between_page_connector,
representation,
representation_relationship,
serial_action_method,
shape_aspect,
shape_aspect_relationship,
symbol_target,
text_literal,
text_style_with_box_characteristics,
view_dependent_invisibility);
END_TYPE; -- named_item

TYPE numeric_measure = NUMBER;
END_TYPE; -- numeric_measure

TYPE organization_item = SELECT
(action_resource,
external_source,
product_category,
product_definition,
product_definition_relationship,
specified_higher_usage_occurrence);
END_TYPE; -- organization_item

```

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```
TYPE parameter_value = REAL;
END_TYPE; -- parameter_value

TYPE person_item = SELECT
  (action_resource);
END_TYPE; -- person_item

TYPE person_organization_select = SELECT
  (person,
   organization,
   person_and_organization);
END_TYPE; -- person_organization_select

TYPE plane_angle_measure = REAL;
END_TYPE; -- plane_angle_measure

TYPE positive_length_measure = length_measure;
WHERE
  wr1: SELF > 0;
END_TYPE; -- positive_length_measure

TYPE positive_plane_angle_measure = plane_angle_measure;
WHERE
  wr1: SELF > 0;
END_TYPE; -- positive_plane_angle_measure

TYPE positive_ratio_measure = ratio_measure;
WHERE
  wr1: SELF > 0;
END_TYPE; -- positive_ratio_measure

TYPE possessed_class_of_property_item = SELECT
  (class_of_activity,
   class_of_facility,
   class_of_material);
END_TYPE; -- possessed_class_of_property_item

TYPE presentable_text = STRING;
END_TYPE; -- presentable_text

TYPE presentation_representation_select = SELECT
  (presentation_representation,
   presentation_set);
END_TYPE; -- presentation_representation_select

TYPE presentation_size_assignment_select = SELECT
  (presentation_view,
   presentation_area,
   area_in_set);
END_TYPE; -- presentation_size_assignment_select
```

```

TYPE presentation_style_select = SELECT
  (curve_style,
   symbol_style,
   fill_area_style,
   text_style);
END_TYPE; -- presentation_style_select

TYPE presented_facility_class_item = SELECT
  (class_of_facility);
END_TYPE; -- presented_facility_class_item

TYPE presented_material_class_item = SELECT
  (class_of_material);
END_TYPE; -- presented_material_class_item

TYPE process_or_process_relationship = SELECT
  (relationship_with_condition);
END_TYPE; -- process_or_process_relationship

TYPE property_or_shape_select = SELECT
  (property_definition,
   shape_definition);
END_TYPE; -- property_or_shape_select

TYPE ratio_measure = REAL;
END_TYPE; -- ratio_measure

TYPE relationship_with_condition = SELECT
  (action_relationship,
   action_method_relationship);
END_TYPE; -- relationship_with_condition

TYPE represented_definition = SELECT
  (property_definition,
   shape_aspect,
   shape_aspect_relationship);
END_TYPE; -- represented_definition

TYPE second_in_minute = REAL;
WHERE
  wr1: (0 <= SELF) AND (SELF <= 60);
END_TYPE; -- second_in_minute

TYPE shape_definition = SELECT
  (product_definition_shape,
   shape_aspect,
   shape_aspect_relationship);
END_TYPE; -- shape_definition

```

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```
TYPE si_prefix = ENUMERATION OF
(exa,
 peta,
 tera,
 giga,
 mega,
 kilo,
 hecto,
 deca,
 deci,
 centi,
 milli,
 micro,
 nano,
 pico,
 femto,
 atto);
END_TYPE; -- si_prefix

TYPE si_unit_name = ENUMERATION OF
(metre,
 gram,
 second,
 ampere,
 kelvin,
 mole,
 candela,
 radian,
 steradian,
 hertz,
 newton,
 pascal,
 joule,
 watt,
 coulomb,
 volt,
 farad,
 ohm,
 siemens,
 weber,
 tesla,
 henry,
 degree_celsius,
 lumen,
 lux,
 becquerel,
 gray,
```

```

    sievert);
END_TYPE; -- si_unit_name

TYPE size_select = SELECT
  (positive_length_measure,
   measure_with_unit,
   descriptive_measure);
END_TYPE; -- size_select

TYPE solid_angle_measure = REAL;
END_TYPE; -- solid_angle_measure

TYPE source_item = SELECT
  (identifier);
END_TYPE; -- source_item

TYPE style_context_select = SELECT
  (representation,
   representation_item,
   presentation_set);
END_TYPE; -- style_context_select

TYPE supported_item = SELECT
  (action,
   action_method);
END_TYPE; -- supported_item

TYPE symbol_library_item = SELECT
  (symbol_representation);
END_TYPE; -- symbol_library_item

TYPE symbol_style_select = SELECT
  (symbol_colour);
END_TYPE; -- symbol_style_select

TYPE text = STRING;
END_TYPE; -- text

TYPE text_alignment = label;
END_TYPE; -- text_alignment

TYPE text_delineation = label;
END_TYPE; -- text_delineation

TYPE text_or_character = SELECT
  (annotation_text,
   composite_text,
   text_literal);
END_TYPE; -- text_or_character

```

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```
TYPE text_path = ENUMERATION OF
  (left,
   right,
   up,
   down);
END_TYPE; -- text_path

TYPE thermodynamic_temperature_measure = REAL;
END_TYPE; -- thermodynamic_temperature_measure

TYPE time_measure = REAL;
END_TYPE; -- time_measure

TYPE transfer_material_item = SELECT
  (product_definition);
END_TYPE; -- transfer_material_item

TYPE transfer_source_destination_item = SELECT
  (product_definition);
END_TYPE; -- transfer_source_destination_item

TYPE transform_material_item = SELECT
  (product_definition);
END_TYPE; -- transform_material_item

TYPE transformation = SELECT
  (item_defined_transformation);
END_TYPE; -- transformation

TYPE transition_code = ENUMERATION OF
  (discontinuous,
   continuous,
   cont_same_gradient,
   cont_same_gradient_same_curvature);
END_TYPE; -- transition_code

TYPE trimming_preference = ENUMERATION OF
  (cartesian,
   parameter,
   unspecified);
END_TYPE; -- trimming_preference

TYPE trimming_select = SELECT
  (cartesian_point,
   parameter_value);
END_TYPE; -- trimming_select

TYPE typical_facility_catalogue_item = SELECT
  (product_definition);
END_TYPE; -- typical_facility_catalogue_item
```

```

TYPE typical_material_catalogue_item = SELECT
  (product_definition);
END_TYPE; -- typical_material_catalogue_item

TYPE unit = SELECT
  (named_unit,
   derived_unit);
END_TYPE; -- unit

TYPE value_qualifier = SELECT
  (type_qualifier);
END_TYPE; -- value_qualifier

TYPE vector_or_direction = SELECT
  (vector,
   direction);
END_TYPE; -- vector_or_direction

TYPE volume_measure = REAL;
END_TYPE; -- volume_measure

TYPE year_number = INTEGER;
END_TYPE; -- year_number

ENTITY action;
  id          : identifier;
  name        : label;
  description : text;
  chosen_method : action_method;
END_ENTITY; -- action

ENTITY action_assignment
  ABSTRACT SUPERTYPE;
    assigned_action : action;
    role           : action_role;
END_ENTITY; -- action_assignment

ENTITY action_composition
  SUBTYPE OF (action, action_relationship);
END_ENTITY; -- action_composition

ENTITY action_method;
  name        : label;
  description : text;
  consequence : text;
  purpose     : text;
END_ENTITY; -- action_method

ENTITY action_method_composition
  SUBTYPE OF (action_method, action_method_relationship);
END_ENTITY; -- action_method_composition

```

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```
ENTITY action_method_relationship;
  name          : label;
  description    : text;
  relating_method : action_method;
  related_method  : action_method;
END_ENTITY; -- action_method_relationship

ENTITY action_method_sequence
  SUBTYPE OF (action_method, action_method_relationship);
END_ENTITY; -- action_method_sequence

ENTITY action_property;
  name          : label;
  description    : text;
  definition    : characterized_action_definition;
END_ENTITY; -- action_property

ENTITY action_property_relationship;
  name          : label;
  description    : text;
  relating_action_property : action_property;
  related_action_property : action_property;
WHERE
  wr1: relating_action_property :<>: related_action_property;
END_ENTITY; -- action_property_relationship

ENTITY action_property_representation;
  name          : label;
  description    : text;
  property       : action_property;
  representation  : representation;
END_ENTITY; -- action_property_representation

ENTITY action_relationship;
  name          : label;
  description    : text;
  relating_action : action;
  related_action  : action;
END_ENTITY; -- action_relationship

ENTITY action_resource;
  name          : label;
  description    : text;
  usage         : SET [1:?] OF supported_item;
  kind          : action_resource_type;
END_ENTITY; -- action_resource

ENTITY action_resource_type;
  name : label;
END_ENTITY; -- action_resource_type
```

```

ENTITY action_role;
  name          : label;
  description   : text;
END_ENTITY; -- action_role

ENTITY action_sequence
  SUBTYPE OF (action, action_relationship);
END_ENTITY; -- action_sequence

ENTITY address;
  internal_location      : OPTIONAL label;
  street_number           : OPTIONAL label;
  street                  : OPTIONAL label;
  postal_box               : OPTIONAL label;
  town                    : OPTIONAL label;
  region                  : OPTIONAL label;
  postal_code              : OPTIONAL label;
  country                 : OPTIONAL label;
  facsimile_number        : OPTIONAL label;
  telephone_number         : OPTIONAL label;
  electronic_mail_address : OPTIONAL label;
  telex_number             : OPTIONAL label;
WHERE
  wr1: EXISTS(internal_location) OR EXISTS(street_number) OR EXISTS(
    street) OR EXISTS(postal_box) OR EXISTS(town) OR EXISTS(
    region) OR EXISTS(postal_code) OR EXISTS(country) OR EXISTS(
    facsimile_number) OR EXISTS(telephone_number) OR EXISTS(
    electronic_mail_address) OR EXISTS(telex_number);
END_ENTITY; -- address

ENTITY alternate_connection_identification
  SUBTYPE OF (product_definition_relationship);
WHERE
  wr1: SIZEOF(QUERY ( pdr <* USEDIN(SELF.relating_product_definition,
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
    'RELATING_PRODUCT_DEFINTION') | ((SIZEOF(TYPEOF(pdr) * [
    'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL',
    'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY'])) = 1) AND (
    pdr.related_product_definition ::= SELF.
    related_product_definition)) ) = 1;
END_ENTITY; -- alternate_connection_identification

ENTITY amount_of_substance_measure_with_unit
  SUBTYPE OF (measure_with_unit);
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.AMOUNT_OF_SUBSTANCE_UNIT' IN TYPEOF(SELF
    \measure_with_unit.unit_component);
END_ENTITY; -- amount_of_substance_measure_with_unit

```

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```
ENTITY amount_of_substance_unit
SUBTYPE OF (named_unit);
WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
        named_unit.dimensions.mass_exponent = 0) AND (SELF\
        named_unit.dimensions.time_exponent = 0) AND (SELF\
        named_unit.dimensions.electric_current_exponent = 0) AND (
            SELF\named_unit.dimensions.
            thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
            .dimensions.amount_of_substance_exponent = 1) AND (SELF\
            named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- amount_of_substance_unit

ENTITY annotation_curve_occurrence
SUBTYPE OF (annotation_occurrence);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CURVE' IN TYPEOF(SELF\styled_item.item);
END_ENTITY; -- annotation_curve_occurrence

ENTITY annotation_fill_area
SUBTYPE OF (geometric_representation_item);
boundaries : SET [1:?] OF curve;
END_ENTITY; -- annotation_fill_area

ENTITY annotation_fill_area_occurrence
SUBTYPE OF (annotation_occurrence);
fill_style_target : point;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.ANNOTATION_FILL_AREA' IN TYPEOF(SELF.
        item);
END_ENTITY; -- annotation_fill_area_occurrence

ENTITY annotation_occurrence
SUPERTYPE OF (ONEOF (annotation_curve_occurrence,
    annotation_fill_area_occurrence,annotation_text_occurrence,
    annotation_symbol_occurrence))
SUBTYPE OF (styled_item);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.GEOMETRIC REPRESENTATION ITEM' IN
        TYPEOF(SELF);
END_ENTITY; -- annotation_occurrence

ENTITY annotation_occurrence_relationship;
name : label;
description : text;
relating_annotation_occurrence : annotation_occurrence;
related_annotation_occurrence : annotation_occurrence;
END_ENTITY; -- annotation_occurrence_relationship
```

```

ENTITY annotation_symbol
  SUBTYPE OF (mapped_item);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.SYMBOL_REPRESENTATION_MAP' IN TYPEOF(
      SELF\mapped_item.mapping_source);
    wr2: 'PLANT_FUNCTIONAL_DATA.SYMBOL_TARGET' IN TYPEOF(SELF\
      mapped_item.mapping_target);
    wr3: 'PLANT_FUNCTIONAL_DATA.GEOMETRIC REPRESENTATION_ITEM' IN
      TYPEOF(SELF);
  END_ENTITY; -- annotation_symbol

ENTITY annotation_symbol_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: SIZEOF(['PLANT_FUNCTIONAL_DATA.ANNOTATION_SYMBOL',
      'PLANT_FUNCTIONAL_DATA.DEFINED_SYMBOL']) * TYPEOF(SELF\
      styled_item.item)) > 0;
  END_ENTITY; -- annotation_symbol_occurrence

ENTITY annotation_text
  SUBTYPE OF (mapped_item);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.AXIS2_PLACEMENT' IN TYPEOF(SELF\
      mapped_item.mapping_target);
    wr2: 'PLANT_FUNCTIONAL_DATA.TEXT_STRING_REPRESENTATION' IN TYPEOF(
      SELF\mapped_item.mapping_source.mapped_representation);
    wr3: 'PLANT_FUNCTIONAL_DATA.GEOMETRIC REPRESENTATION_ITEM' IN
      TYPEOF(SELF);
  END_ENTITY; -- annotation_text

ENTITY annotation_text_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: SIZEOF(['PLANT_FUNCTIONAL_DATA.TEXT_LITERAL',
      'PLANT_FUNCTIONAL_DATA.ANNOTATION_TEXT',
      'PLANT_FUNCTIONAL_DATA.ANNOTATION_TEXT_CHARACTER',
      'PLANT_FUNCTIONAL_DATA.DEFINED_CHARACTER_GLYPH',
      'PLANT_FUNCTIONAL_DATA.COMPOSITE_TEXT']) * TYPEOF(SELF\
      styled_item.item)) > 0;
  END_ENTITY; -- annotation_text_occurrence

ENTITY annotation_text_with_extent
  SUBTYPE OF (annotation_text);
  extent : planar_extent;
  END_ENTITY; -- annotation_text_with_extent

ENTITY application_context;
  name          : label;

```

```

        description : text;
INVERSE
        context_elements : SET [1:?] OF application_context_element FOR
                            frame_of_reference;
END_ENTITY; -- application_context

ENTITY application_context_element
    SUPERTYPE OF (ONEOF (product_context,product_definition_context,
        library_context));
    name           : label;
    frame_of_reference : SET [1:?] OF application_context;
END_ENTITY; -- application_context_element

ENTITY application_protocol_definition;
    status           : label;
    application_interpreted_model_schema_name : label;
    application_protocol_year      : year_number;
    application          : SET [1:?] OF
                            application_context;
END_ENTITY; -- application_protocol_definition

ENTITY approval;
    status : approval_status;
    level  : label;
END_ENTITY; -- approval

ENTITY approval_assignment
    ABSTRACT SUPERTYPE;
    assigned_approval : approval;
    role              : approval_role;
END_ENTITY; -- approval_assignment

ENTITY approval_role;
    name       : label;
    description : text;
END_ENTITY; -- approval_role

ENTITY approval_status;
    name : label;
END_ENTITY; -- approval_status

ENTITY area_in_set;
    area   : presentation_area;
    in_set : presentation_set;
END_ENTITY; -- area_in_set

ENTITY area_measure_with_unit
    SUBTYPE OF (measure_with_unit);
    WHERE

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wr1: 'PLANT_FUNCTIONAL_DATA.AREA_UNIT' IN TYPEOF(SELF \
    measure_with_unit.unit_component);
END_ENTITY; -- area_measure_with_unit

ENTITY area_unit
    SUBTYPE OF (named_unit);
    WHERE
        wr1: (SELF\named_unit.dimensions.length_exponent = 2) AND (SELF\
            named_unit.dimensions.mass_exponent = 0) AND (SELF\
            named_unit.dimensions.time_exponent = 0) AND (SELF\
            named_unit.dimensions.electric_current_exponent = 0) AND (\
            SELF\named_unit.dimensions.
            thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
            .dimensions.amount_of_substance_exponent = 0) AND (SELF\
            named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- area_unit

ENTITY assembly_component_usage
    SUPERTYPE OF (ONEOF (next_assembly_usage_occurrence,
        specified_higher_usage_occurrence))
    SUBTYPE OF (product_definition_usage);
        reference_designator : OPTIONAL identifier;
END_ENTITY; -- assembly_component_usage

ENTITY assembly_component_usage_substitute;
    name          : label;
    description   : text;
    ranking       : INTEGER;
    ranking_rationale : text;
    base          : assembly_component_usage;
    substitute    : assembly_component_usage;
    UNIQUE
    url : base, substitute;
    WHERE
        wr1: base.relating_product_definition ::= substitute.
            relating_product_definition;
        wr2: base :<>: substitute;
END_ENTITY; -- assembly_component_usage_substitute

ENTITY assembly_of_facility
    SUBTYPE OF (assembly_component_usage, product_definition);
    WHERE
        wr1: SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name IN [
                'functional definition', 'functional occurrence'];
        wr2: SELF\product_definition_relationship.related_product_definition
            .frame_of_reference.name IN ['functional definition',
                'functional occurrence'];

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```

wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional definition');
wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional occurrence');
END_ENTITY; -- assembly_of_facility

ENTITY assembly_of_material
  SUBTYPE OF (assembly_component_usage, product_definition);
  WHERE
    wr1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN [
      'physical definition', 'physical occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition.
      frame_of_reference.name IN ['physical definition',
      'physical occurrence'];
    wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical definition');
    wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical occurrence');
END_ENTITY; -- assembly_of_material

ENTITY axis2_placement_2d
  SUBTYPE OF (placement);
  ref_direction : OPTIONAL direction;
  DERIVE
    p : LIST [2:2] OF direction := build_2axes(ref_direction);
  WHERE
    wr1: SELF\geometric_representation_item.dim = 2;
END_ENTITY; -- axis2_placement_2d

ENTITY b_spline_curve
  SUPERTYPE OF (ONEOF (uniform_curve,b_spline_curve_with_knots,
  quasi_uniform_curve,bezier_curve) ANDOR rational_b_spline_curve)
  SUBTYPE OF (bounded_curve);
  degree : INTEGER;
  control_points_list : LIST [2:?] OF cartesian_point;

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curve_form          : b_spline_curve_form;
closed_curve       : LOGICAL;
self_intersect     : LOGICAL;

DERIVE
  upper_index_on_control_points : INTEGER := SIZEOF(
                                         control_points_list) - 1;
  control_points      : ARRAY [0:
                                upper_index_on_control_points] OF
                           cartesian_point := list_to_array(
                                         control_points_list,0,
                                         upper_index_on_control_points);

WHERE
  wr1: ('PLANT_FUNCTIONAL_DATA.UNIFORM_CURVE' IN TYPEOF(SELF)) OR (
         'PLANT_FUNCTIONAL_DATA.QUASI_UNIFORM_CURVE' IN TYPEOF(SELF))
  OR ('PLANT_FUNCTIONAL_DATA.BEZIER_CURVE' IN TYPEOF(SELF)) OR
    ('PLANT_FUNCTIONAL_DATA.B_SPLINE_CURVE_WITH_KNOTS' IN
     TYPEOF(SELF));
END_ENTITY; -- b_spline_curve

ENTITY b_spline_curve_with_knots
  SUBTYPE OF (b_spline_curve);
    knot_multiplicities : LIST [2:?] OF INTEGER;
    knots               : LIST [2:?] OF parameter_value;
    knot_spec           : knot_type;

DERIVE
  upper_index_on_knots : INTEGER := SIZEOF(knots);

WHERE
  wr1: constraints_param_b_spline(degree,upper_index_on_knots,
                                   upper_index_on_control_points,knot_multiplicities,knots);
  wr2: SIZEOF(knot_multiplicities) = upper_index_on_knots;
END_ENTITY; -- b_spline_curve_with_knots

ENTITY bezier_curve
  SUBTYPE OF (b_spline_curve);
END_ENTITY; -- bezier_curve

ENTITY binary_object_representation
  SUBTYPE OF (representation);

WHERE
  wr1: SELF.context_of_items.context_type =
    'binary object representation';
  wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT
('PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_REPRESENTATION_ITEM'
    IN TYPEOF(item))) )) = 0;
END_ENTITY; -- binary_object_representation

ENTITY bounded_curve
  SUPERTYPE OF (ONEOF (polyline,b_spline_curve,trimmed_curve,

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        composite_curve))
SUBTYPE OF (curve);
END_ENTITY; -- bounded_curve

ENTITY cartesian_point
SUBTYPE OF (point);
coordinates : LIST [1:3] OF length_measure;
END_ENTITY; -- cartesian_point

ENTITY characterized_object;
name          : label;
description   : text;
END_ENTITY; -- characterized_object

ENTITY circle
SUBTYPE OF (conic);
radius : positive_length_measure;
END_ENTITY; -- circle

ENTITY class_of_activity
SUPERTYPE OF (ONEOF (standard_class_of_activity,
externally_defined_class_of_activity))
SUBTYPE OF (group);
END_ENTITY; -- class_of_activity

ENTITY class_of_annotation_element
SUPERTYPE OF (ONEOF (standard_class_of_annotation_element,
externally_defined_class_of_annotation_element))
SUBTYPE OF (group);
END_ENTITY; -- class_of_annotation_element

ENTITY class_of_annotation_element_assembly_constraint
SUPERTYPE OF (
externally_defined_class_of_annotation_element_assembly_constraint)
SUBTYPE OF (group_relationship);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
SELF\group_relationship.relating_group);
wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
SELF\group_relationship.related_group);
END_ENTITY; -- class_of_annotation_element_assembly_constraint

ENTITY class_of_annotation_element_connection_constraint
SUPERTYPE OF (externally_defined_class_of_annotation_element_connection_cons
SUBTYPE OF (group_relationship);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
SELF\group_relationship.relating_group);
wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
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        SELF\group_relationship.related_group);
END_ENTITY; -- class_of_annotation_element_connection_constraint

ENTITY class_of_annotation_element_presentation_of_facility_constraint_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF presented_facility_class_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
      SELF.assigned_group);
END_ENTITY; -- class_of_annotation_element_presentation_of_facility_constraint_assignment

ENTITY class_of_annotation_element_presentation_of_material_constraint_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF presented_material_class_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
      SELF.assigned_group);
END_ENTITY; -- class_of_annotation_element_presentation_of_material_constraint_assignment

ENTITY class_of_facility
  SUPERTYPE OF (ONEOF (standard_class_of_facility,
    externally_defined_class_of_facility))
  SUBTYPE OF (product_category, characterized_object);
END_ENTITY; -- class_of_facility

ENTITY class_of_facility_assembly_constraint
  SUPERTYPE OF (externally_defined_class_of_facility_assembly_constraint)
  SUBTYPE OF (product_category_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF\
      product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF\
      product_category_relationship.sub_category);
END_ENTITY; -- class_of_facility_assembly_constraint

ENTITY class_of_facility_connection_constraint
  SUPERTYPE OF (
    externally_defined_class_of_facility_connection_constraint)
  SUBTYPE OF (product_category_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF\
      product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF\
      product_category_relationship.sub_category);
END_ENTITY; -- class_of_facility_connection_constraint

ENTITY class_of_information_content
  SUPERTYPE OF (ONEOF (standard_class_of_information_content,
    externally_defined_class_of_information_content))

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SUBTYPE OF (group);
WHERE
  wr1: (SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_INFORMATION_' +
    'CONTENT_ASSIGNMENT.ITEMS')) + SIZEOF(QUERY ( gr <* USEDIN(
  SELF,'PLANT_FUNCTIONAL_DATA.' +
    'GROUP_RELATIONSHIP.RELATING_GROUP') | (
    'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT' IN
    TYPEOF(gr.related_group) ) ) + SIZEOF(USEDIN(SELF,
    'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_INFORMATION_CONTENT_' +
    'LIBRARY_ASSIGNMENT.ITEMS'))) ) >= 1;
END_ENTITY; -- class_of_information_content

ENTITY class_of_information_content_composition_constraint
  SUBTYPE OF (group_relationship);
  WHERE
    wr1: 'PLANT_FUNCTION_SCHEMA.CLASS_OF_INFORMATION_CONTENT' IN TYPEOF(
      SELF.relatting_group);
    wr2: 'PLANT_FUNCTION_SCHEMA.CLASS_OF_INFORMATION_CONTENT' IN TYPEOF(
      SELF.related_group);
END_ENTITY; -- class_of_information_content_composition_constraint

ENTITY class_of_involvement
  SUPERTYPE OF (ONEOF (standard_class_of_involvement,
    externally_defined_class_of_involvement))
  SUBTYPE OF (group);
END_ENTITY; -- class_of_involvement

ENTITY class_of_material
  SUPERTYPE OF (ONEOF (standard_class_of_material,
    externally_defined_class_of_material))
  SUBTYPE OF (product_category, characterized_object);
END_ENTITY; -- class_of_material

ENTITY class_of_material_assembly_constraint
  SUPERTYPE OF (externally_defined_class_of_material_assembly_constraint)
  SUBTYPE OF (product_category_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
      product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
      product_category_relationship.sub_category);
END_ENTITY; -- class_of_material_assembly_constraint

ENTITY class_of_material_connection_constraint
  SUPERTYPE OF (
    externally_defined_class_of_material_connection_constraint)

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SUBTYPE OF (product_category_relationship);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
        product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
        product_category_relationship.sub_category);
END_ENTITY; -- class_of_material_connection_constraint

ENTITY class_of_property
    SUPERTYPE OF (ONEOF (standard_class_of_property,
        externally_defined_class_of_property))
    SUBTYPE OF (group);
END_ENTITY; -- class_of_property

ENTITY class_of_substance
    SUBTYPE OF (class_of_material);
END_ENTITY; -- class_of_substance

ENTITY classification_of_class_of_annotation_element
    SUPERTYPE OF (
        externally_defined_classification_of_class_of_annotation_element)
    SUBTYPE OF (group_relationship);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
        SELF\group_relationship.relating_group);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
        SELF\group_relationship.related_group);
END_ENTITY; -- classification_of_class_of_annotation_element

ENTITY classification_of_class_of_facility
    SUPERTYPE OF (ONEOF (standard_classification_of_class_of_facility,
        externally_defined_classification_of_class_of_facility))
    SUBTYPE OF (product_category_relationship);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF \
        product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF \
        product_category_relationship.sub_category);
END_ENTITY; -- classification_of_class_of_facility

ENTITY classification_of_class_of_material
    SUPERTYPE OF (ONEOF (standard_classification_of_class_of_material,
        externally_defined_classification_of_class_of_material))
    SUBTYPE OF (product_category_relationship);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
        product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \

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        product_category_relationship.sub_category);
END_ENTITY; -- classification_of_class_of_material

ENTITY classification_of_facility
SUBTYPE OF (product_related_product_category);
WHERE
    wr1: SELF.name = 'classifier';
    wr2: SIZEOF(QUERY ( pcr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') | ((pcr.name =
        'class assignment') AND (
        'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(pcr.
        sub_category)))) ) >= 1;
    wr3: SIZEOF(SELF.products) = 1;
    wr4: SIZEOF(QUERY ( pdf <* USEDIN(SELF.products[1],
        'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') | (NOT (SIZEOF(
        QUERY ( pd <* USEDIN(pdf,'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_DEFINITION_FORMATION') | (NOT (pd\
        product_definition.frame_of_reference.name IN [
        'functional definition','functional occurrence'])) ) = 0)) ) ) =
        0;
END_ENTITY; -- classification_of_facility

ENTITY classification_of_material
SUBTYPE OF (product_related_product_category);
WHERE
    wr1: SELF.name = 'classifier';
    wr2: SIZEOF(QUERY ( pcr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') | ((pcr.name =
        'class assignment') AND (
        'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(pcr.
        sub_category)))) ) >= 1;
    wr3: SIZEOF(SELF.products) = 1;
    wr4: SIZEOF(QUERY ( pdf <* USEDIN(SELF.products[1],
        'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') | (NOT (SIZEOF(
        QUERY ( pd <* USEDIN(pdf,'PLANT_FUNCTIONAL_DATA.' +
        'PRODUCT_DEFINITION_FORMATION') | (NOT (pd\
        product_definition.frame_of_reference.name IN [
        'physical definition','physical occurrence')) ) = 0)) ) ) =
        0;
END_ENTITY; -- classification_of_material

ENTITY collection_of_facility
SUBTYPE OF (product_definition_usage, product_definition);
WHERE
    wr1: SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [

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        'functional definition','functional occurrence'];
wr2: SELF\product_definition_relationship.related_product_definition
      .frame_of_reference.name IN ['functional definition',
      'functional occurrence'];
wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional definition');
wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'functional occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional occurrence');
END_ENTITY; -- collection_of_facility

ENTITY collection_of_material
SUBTYPE OF (product_definition_usage, product_definition);
WHERE
  wr1: SELF\product_definition_relationship.
    relating_product_definition.frame_of_reference.name IN [
      'physical definition','physical occurrence'];
wr2: SELF\product_definition_relationship.related_product_definition
      .frame_of_reference.name IN ['physical definition',
      'physical occurrence'];
wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical definition');
wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical occurrence');
END_ENTITY; -- collection_of_material

ENTITY colour;
END_ENTITY; -- colour

ENTITY colour_rgb
SUBTYPE OF (colour_specification);
  red   : REAL;
  green : REAL;
  blue  : REAL;
WHERE
  wr1: (0 <= red) AND (red <= 1);
  wr2: (0 <= green) AND (green <= 1);

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    wr3: (0 <= blue) AND (blue <= 1);
END_ENTITY; -- colour_rgb

ENTITY colour_specification
  SUBTYPE OF (colour);
  name : label;
END_ENTITY; -- colour_specification

ENTITY composite_curve
  SUBTYPE OF (bounded_curve);
  segments      : LIST [1:?] OF composite_curve_segment;
  self_intersect : LOGICAL;
DERIVE
  n_segments   : INTEGER := SIZEOF(segments);
  closed_curve : LOGICAL := segments[n_segments].transition <>
                            discontinuous;
WHERE
  wr1: ((NOT closed_curve) AND (SIZEOF(QUERY ( temp <* segments | (
    temp.transition = discontinuous) )) = 1)) OR (closed_curve
  AND (SIZEOF(QUERY ( temp <* segments | (temp.transition =
  discontinuous) )) = 0));
END_ENTITY; -- composite_curve

ENTITY composite_curve_segment;
  transition   : transition_code;
  same_sense   : BOOLEAN;
  parent_curve : curve;
INVERSE
  using_curves : BAG [1:?] OF composite_curve FOR segments;
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.BOUNDED_CURVE' IN TYPEOF(parent_curve);
END_ENTITY; -- composite_curve_segment

ENTITY composite_text
  SUBTYPE OF (geometric_representation_item);
  collected_text : SET [2:?] OF text_or_character;
WHERE
  wr1: acyclic_composite_text(SELF, SELF.collected_text);
END_ENTITY; -- composite_text

ENTITY composite_text_with_associated_curves
  SUBTYPE OF (composite_text);
  associated_curves : SET [1:?] OF curve;
END_ENTITY; -- composite_text_with_associated_curves

ENTITY composite_text_with_blanking_box
  SUBTYPE OF (composite_text);
  blanking : planar_box;
END_ENTITY; -- composite_text_with_blanking_box
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ENTITY composite_text_with_extent
  SUBTYPE OF (composite_text);
    extent : planar_extent;
END_ENTITY; -- composite_text_with_extent

ENTITY conic
  SUPERTYPE OF (ONEOF (circle,ellipse,hyperbola,parabola))
  SUBTYPE OF (curve);
    position : axis2_placement;
END_ENTITY; -- conic

ENTITY connection_of_facility
  SUBTYPE OF (product_definition_relationship, product_definition);
  WHERE
    wr1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN [
        'functional definition', 'functional occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition
      .frame_of_reference.name IN ['functional definition',
        'functional occurrence'];
    wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
        'functional definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional definition');
    wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
        'functional occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'functional occurrence');
    wr5: SELF.relating_product_definition.description = SELF.
      related_product_definition.description;
END_ENTITY; -- connection_of_facility

ENTITY connection_of_material
  SUBTYPE OF (product_definition_relationship, characterized_object);
  WHERE
    wr1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN [
        'physical definition', 'physical occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition
      .frame_of_reference.name IN ['physical definition',
        'physical occurrence'];
    wr3: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
        'physical definition') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical definition');

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wr4: (SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name <>
      'physical occurrence') OR (SELF\
      product_definition_relationship.related_product_definition.
      frame_of_reference.name = 'physical occurrence');
wr5: SELF.relating_product_definition.description = SELF.
      related_product_definition.description;
END_ENTITY; -- connection_of_material

ENTITY connection_shape_aspect
  SUBTYPE OF (shape_aspect);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL' IN TYPEOF(SELF.
      of_shape.definition);
END_ENTITY; -- connection_shape_aspect

ENTITY connector_feature_annotation_occurrence
  SUBTYPE OF (annotation_occurrence);
  WHERE
    wr1: SIZEOF(QUERY ( aor <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'ANNOTATION_OCCURRENCE_RELATIONSHIP.' +
      'RELATED_ANNOTATION_OCCURRENCE') | (
      'PLANT_FUNCTIONAL_DATA.POSSESSION_OF_CONNECTOR_FEATURE' IN
      TYPEOF(aor)) )) >= 1;
END_ENTITY; -- connector_feature_annotation_occurrence

ENTITY context_dependent_invisibility
  SUBTYPE OF (invisibility);
  presentation_context : invisibility_context;
END_ENTITY; -- context_dependent_invisibility

ENTITY context_dependent_unit
  SUBTYPE OF (named_unit);
  name : label;
END_ENTITY; -- context_dependent_unit

ENTITY conversion_based_unit
  SUBTYPE OF (named_unit);
  name : label;
  conversion_factor : measure_with_unit;
END_ENTITY; -- conversion_based_unit

ENTITY coordinated_universal_time_offset;
  hour_offset : hour_in_day;
  minute_offset : OPTIONAL minute_in_hour;
  sense : ahead_or_behind;
END_ENTITY; -- coordinated_universal_time_offset

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ENTITY curve
  SUPERTYPE OF (ONEOF (line,conic,offset_curve_2d))
  SUBTYPE OF (geometric_representation_item);
END_ENTITY; -- curve

ENTITY curve_style;
  name          : label;
  curve_font    : curve_font_or_scaled_curve_font_select;
  curve_width   : size_select;
  curve_colour  : colour;
END_ENTITY; -- curve_style

ENTITY curve_style_font;
  name          : label;
  pattern_list : LIST [1:?] OF curve_style_font_pattern;
END_ENTITY; -- curve_style_font

ENTITY curve_style_font_pattern;
  visible_segment_length  : positive_length_measure;
  invisible_segment_length : positive_length_measure;
END_ENTITY; -- curve_style_font_pattern

ENTITY date;
  year_component : year_number;
END_ENTITY; -- date

ENTITY date_and_time;
  date_component : date;
  time_component : local_time;
END_ENTITY; -- date_and_time

ENTITY dated_effectivity
  SUBTYPE OF (effectivity);
  effectivity_start_date : date_and_time;
  effectivity_end_date   : OPTIONAL date_and_time;
END_ENTITY; -- dated_effectivity

ENTITY defined_symbol
  SUBTYPE OF (geometric_representation_item);
  definition : defined_symbol_select;
  target      : symbol_target;
END_ENTITY; -- defined_symbol

ENTITY derived_unit;
  elements : SET [1:?] OF derived_unit_element;
  WHERE
    wr1: (SIZEOF(elements) > 1) OR ((SIZEOF(elements) = 1) AND (elements
      [1].exponent <> 1));
END_ENTITY; -- derived_unit

```

```

ENTITY derived_unit_element;
  unit      : named_unit;
  exponent   : REAL;
END_ENTITY; -- derived_unit_element

ENTITY descriptive_representation_item
  SUBTYPE OF (representation_item);
  description : text;
END_ENTITY; -- descriptive_representation_item

ENTITY dimensional_exponents;
  length_exponent           : REAL;
  mass_exponent              : REAL;
  time_exponent              : REAL;
  electric_current_exponent : REAL;
  thermodynamic_temperature_exponent : REAL;
  amount_of_substance_exponent : REAL;
  luminous_intensity_exponent : REAL;
END_ENTITY; -- dimensional_exponents

ENTITY direction
  SUBTYPE OF (geometric_representation_item);
  direction_ratios : LIST [2:3] OF REAL;
  WHERE
    wr1: SIZEOF(QUERY ( tmp <* direction_ratios | (tmp <> 0) )) > 0;
END_ENTITY; -- direction

ENTITY direction_range_for_connector_feature
  SUBTYPE OF (mapped_item);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.DIRECTION_RANGE_REPRESENTATION' IN
          TYPEOF(SELF.mapping_source.mapped_representation);
    wr2: 'PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'
          IN TYPEOF(SELF.mapping_target);
END_ENTITY; -- direction_range_for_connector_feature

ENTITY direction_range_representation
  SUBTYPE OF (representation);
  WHERE
    wr1: SIZEOF(SELF.items) = 2;
    wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT (
          'PLANT_FUNCTIONAL_DATA.AXIS2_PLACEMENT_2D' IN TYPEOF(item))) )) =
          0;
    wr3: SIZEOF(QUERY ( item <* SELF.items | (item\representation_item.
          name = 'from') )) = 1;
    wr4: SIZEOF(QUERY ( item <* SELF.items | (item\representation_item.
          name = 'to') )) = 1;
END_ENTITY; -- direction_range_representation

```

```

ENTITY document;
  id          : identifier;
  name        : label;
  description : text;
  kind        : document_type;
END_ENTITY; -- document

ENTITY document_reference
  ABSTRACT SUPERTYPE;
  assigned_document : document;
  source           : label;
  role             : document_role;
END_ENTITY; -- document_reference

ENTITY document_role;
  name      : label;
  description : text;
END_ENTITY; -- document_role

ENTITY document_type;
  product_data_type : label;
END_ENTITY; -- document_type

ENTITY draughting_callout
  SUBTYPE OF (geometric_representation_item);
  contents : SET [1:?] OF draughting_callout_element;
END_ENTITY; -- draughting_callout

ENTITY draughting_callout_relationship;
  name          : label;
  description    : text;
  relating_draughting_callout : draughting_callout;
  related_draughting_callout   : draughting_callout;
END_ENTITY; -- draughting_callout_relationship

ENTITY draughting_title;
  items     : SET [1:?] OF draughting_titled_item;
  language  : label;
  contents  : text;
END_ENTITY; -- draughting_title

ENTITY drawing_definition;
  drawing_number : identifier;
  drawing_type   : OPTIONAL label;
END_ENTITY; -- drawing_definition

ENTITY drawing_revision
  SUBTYPE OF (presentation_set);
  revision_identifier : identifier;

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drawing_identifier : drawing_definition;
intended_scale      : OPTIONAL text;
UNIQUE
url : revision_identifier, drawing_identifier;
END_ENTITY; -- drawing_revision

ENTITY drawing_sheet_revision
SUBTYPE OF (presentation_area);
revision_identifier : identifier;
WHERE
wr1: SIZEOF(QUERY ( item <* SELF\representation.items | (((
'PLANT_FUNCTIONAL_DATA.MAPPED_ITEM' IN TYPEOF(item)) AND (
'PLANT_FUNCTIONAL_DATA.DRAWING_SHEET_REVISION' IN TYPEOF(
item\mapped_item.mapping_source.mapped_representation))) )) =
0;
END_ENTITY; -- drawing_sheet_revision

ENTITY drawing_sheet_revision_usage
SUBTYPE OF (area_in_set);
sheet_number : identifier;
UNIQUE
url : sheet_number, in_set;
WHERE
wr1: ('PLANT_FUNCTIONAL_DATA.DRAWING_SHEET_REVISION' IN (TYPEOF(SELF \
area_in_set.area) AND
'PLANT_FUNCTIONAL_DATA.DRAWING_REVISION')) IN TYPEOF(SELF \
area_in_set.in_set);
END_ENTITY; -- drawing_sheet_revision_usage

ENTITY effectivity
SUPERTYPE OF (dated_effectivity);
id          : identifier;
name        : label;
description : text;
END_ENTITY; -- effectivity

ENTITY effectivity_assignment
ABSTRACT SUPERTYPE;
assigned_effectivity : effectivity;
role              : effectivity_role;
END_ENTITY; -- effectivity_assignment

ENTITY effectivity_relationship;
name          : label;
description   : text;
relating_effectivity : effectivity;
related_effectivity : effectivity;
END_ENTITY; -- effectivity_relationship

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ENTITY effectivity_role;
  name      : label;
  description : text;
END_ENTITY; -- effectivity_role

ENTITY electric_current_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.ELECTRIC_CURRENT_UNIT' IN TYPEOF(SELF \
      measure_with_unit.unit_component);
END_ENTITY; -- electric_current_measure_with_unit

ENTITY electric_current_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF \
      named_unit.dimensions.mass_exponent = 0) AND (SELF \
      named_unit.dimensions.time_exponent = 0) AND (SELF \
      named_unit.dimensions.electric_current_exponent = 1) AND ( \
      SELF\named_unit.dimensions. \
      thermodynamic_temperature_exponent = 0) AND (SELF\named_unit \
      .dimensions.amount_of_substance_exponent = 0) AND (SELF \
      named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- electric_current_unit

ENTITY ellipse
  SUBTYPE OF (conic);
  semi_axis_1 : positive_length_measure;
  semi_axis_2 : positive_length_measure;
END_ENTITY; -- ellipse

ENTITY expression_conversion_based_unit
  SUBTYPE OF (named_unit);
  name      : label;
  conversion_basis : expression_definition;
END_ENTITY; -- expression_conversion_based_unit

ENTITY expression_definition;
  name      : label;
  description : text;
  operator   : label;
  first_operand : expression_operand;
  second_operand : expression_operand;
END_ENTITY; -- expression_definition

ENTITY external_identification_assignment
  ABSTRACT SUPERTYPE
  SUBTYPE OF (identification_assignment);
  source : external_source;
END_ENTITY; -- external_identification_assignment

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ENTITY external_referent_assignment
ABSTRACT SUPERTYPE;
    assigned_name : label;
    role          : external_referent_role;
UNIQUE
    url : assigned_name;
END_ENTITY; -- external_referent_assignment

ENTITY external_referent_role;
    name      : label;
    description : text;
END_ENTITY; -- external_referent_role

ENTITY external_source;
    source_id   : source_item;
    description : text;
END_ENTITY; -- external_source

ENTITY external_source_product_definition_alias
SUBTYPE OF (external_source);
WHERE
    wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
        'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1;
END_ENTITY; -- external_source_product_definition_alias

ENTITY externally_defined_class_of_activity
SUBTYPE OF (class_of_activity, externally_defined_item);
WHERE
    wr1: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_activity

ENTITY externally_defined_class_of_annotation_element
SUBTYPE OF (class_of_annotation_element, externally_defined_item);
WHERE
    wr1: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_annotation_element

ENTITY externally_defined_class_of_annotation_element_assembly_constraint
SUBTYPE OF (class_of_annotation_element_assembly_constraint,
            externally_defined_item);
WHERE
    wr1: SELF\group_relationship.name = SELF\externally_defined_item.
        item_id;
END_ENTITY; -- externally_defined_class_of_annotation_element_assembly_constraint

ENTITY externally_defined_class_of_annotation_element_connection_constraint
SUBTYPE OF (class_of_annotation_element_connection_constraint,
            externally_defined_item);
WHERE

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wrl: SELF\group_relationship.name = SELF\externally_defined_item.
      item_id;
END_ENTITY; -- externally_defined_class_of_annotation_element_connection_constraint

ENTITY externally_defined_class_of_facility
  SUBTYPE OF (class_of_facility, externally_defined_item);
  WHERE
    wrl: SELF\product_category.name = SELF\externally_defined_item.
          item_id;
END_ENTITY; -- externally_defined_class_of_facility

ENTITY externally_defined_class_of_facility_assembly_constraint
  SUBTYPE OF (class_of_facility_assembly_constraint,
              externally_defined_item);
  WHERE
    wrl: SELF\product_category_relationship.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_facility_assembly_constraint

ENTITY externally_defined_class_of_facility_connection_constraint
  SUBTYPE OF (class_of_facility_connection_constraint,
              externally_defined_item);
  WHERE
    wrl: SELF\product_category_relationship.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_facility_connection_constraint

ENTITY externally_defined_class_of_information_content
  SUBTYPE OF (class_of_information_content, externally_defined_item);
  WHERE
    wrl: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_information_content

ENTITY externally_defined_class_of_involvement
  SUBTYPE OF (class_of_involvement, externally_defined_item);
  WHERE
    wrl: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_involvement

ENTITY externally_defined_class_of_material
  SUBTYPE OF (class_of_material, externally_defined_item);
  WHERE
    wrl: SELF\product_category.name = SELF\externally_defined_item.
          item_id;
END_ENTITY; -- externally_defined_class_of_material

ENTITY externally_defined_class_of_material_assembly_constraint
  SUBTYPE OF (class_of_material_assembly_constraint,
              externally_defined_item);

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WHERE
    wr1: SELF\product_category_relationship.name = SELF\
          externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_material_assembly_constraint

ENTITY externally_defined_class_of_material_connection_constraint
    SUBTYPE OF (class_of_material_connection_constraint,
                externally_defined_item);
WHERE
    wr1: SELF\product_category_relationship.name = SELF\
          externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_material_connection_constraint

ENTITY externally_defined_class_of_property
    SUBTYPE OF (class_of_property, externally_defined_item);
WHERE
    wr1: SELF\group.name = SELF\externally_defined_item.item_id;
END_ENTITY; -- externally_defined_class_of_property

ENTITY externally_defined_classification_of_class_of_annotation_element
    SUBTYPE OF (classification_of_class_of_annotation_element,
                externally_defined_item);
WHERE
    wr1: SELF\group_relationship.name = SELF\externally_defined_item.
          item_id;
END_ENTITY; -- externally_defined_classification_of_class_of_annotation_element

ENTITY externally_defined_classification_of_class_of_facility
    SUBTYPE OF (classification_of_class_of_facility,
                externally_defined_item);
WHERE
    wr1: SELF\product_category_relationship.name = SELF\
          externally_defined_item.item_id;
END_ENTITY; -- externally_defined_classification_of_class_of_facility

ENTITY externally_defined_classification_of_class_of_material
    SUBTYPE OF (classification_of_class_of_material,
                externally_defined_item);
WHERE
    wr1: SELF\product_category_relationship.name = SELF\
          externally_defined_item.item_id;
END_ENTITY; -- externally_defined_classification_of_class_of_material

ENTITY externally_defined_curve_font
    SUBTYPE OF (externally_defined_item);
END_ENTITY; -- externally_defined_curve_font

ENTITY externally_defined_hatch_style
    SUBTYPE OF (externally_defined_item, geometric_representation_item);
END_ENTITY; -- externally_defined_hatch_style
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ENTITY externally_defined_involvement_in_activity_class_constraint
SUBTYPE OF (involvement_in_activity_class_constraint,
externally_defined_item);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_CLASS_OF_ACTIVITY' IN
        TYPEOF(SELF\group_relationship.relating_group);
    wr2: 'PLANT_FUNCTIONAL_DATA.EXTERNALLY_DEFINED_CLASS_OF_INVESTIGATION'
        IN TYPEOF(SELF\group_relationship.related_group);
    wr3: SELF\group_relationship.name = SELF\externally_defined_item.
        item_id;
END_ENTITY; -- externally_defined_involvement_in_activity_class_constraint

ENTITY externally_defined_item;
    item_id : source_item;
    source   : external_source;
END_ENTITY; -- externally_defined_item

ENTITY externally_defined_material_or_facility
SUBTYPE OF (product_definition, externally_defined_item);
WHERE
    wr1: SELF\product_definition.frame_of_reference.name IN [
        'physical definition', 'physical occurrence',
        'functional definition', 'functional occurrence'];
    wr2: SELF\product_definition.id = SELF\externally_defined_item.
        item_id;
END_ENTITY; -- externally_defined_material_or_facility

ENTITY externally_defined_recognized_provision_of_service_according_to_class
SUBTYPE OF (recognized_provision_of_service_according_to_class,
externally_defined_item);
WHERE
    wr1: SELF\product_category_relationship.name = SELF\
        externally_defined_item.item_id;
END_ENTITY; -- externally_defined_recognized_provision_of_service_according_to_class

ENTITY externally_defined_representation_item
SUBTYPE OF (representation_item, externally_defined_item);
WHERE
    wr1: SIZEOF(QUERY ( t <* TYPEOF(SELF) | (NOT ((t LIKE
        '*.REPRESENTATION_ITEM') OR (t LIKE
        '*.EXTERNALLY_DEFINED_ITEM') OR (t LIKE
        '*.EXTERNALLY_DEFINED_REPRESENTATION_ITEM')))) ) = 0;
END_ENTITY; -- externally_defined_representation_item

ENTITY externally_defined_symbol
SUBTYPE OF (externally_defined_item);
END_ENTITY; -- externally_defined_symbol

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ENTITY externally_defined_text_font
  SUBTYPE OF (externally_defined_item);
END_ENTITY; -- externally_defined_text_font

ENTITY externally_defined_tile_style
  SUBTYPE OF (externally_defined_item, geometric_representation_item);
END_ENTITY; -- externally_defined_tile_style

ENTITY facility_port
  SUBTYPE OF (product_definition);
  WHERE
    wr1: SIZEOF(QUERY ( pdr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
'PRODUCT_DEFINITION_RELATIONSHIP.RELATED_PRODUCT_DEFINITION')
      | ('PLANT_FUNCTIONAL_DATA.POSSESSION_OF_FACILITY_PORT' IN
      TYPEOF(pdr)) )) >= 1;
    wr2: SELF\product_definition.frame_of_reference.name IN [
      'functional definition','functional occurrence'];
END_ENTITY; -- facility_port

ENTITY fill_area_style;
  name          : label;
  fill_styles : SET [1:?] OF fill_style_select;
  WHERE
    wr1: SIZEOF(QUERY ( fill_style <* SELF.fill_styles | (((
      'PLANT_FUNCTIONAL_DATA.' + 'FILL_AREA_STYLE_COLOUR') IN
      TYPEOF(fill_style)) )) <= 1;
END_ENTITY; -- fill_area_style

ENTITY fill_area_style_colour;
  name          : label;
  fill_colour  : colour;
END_ENTITY; -- fill_area_style_colour

ENTITY fill_area_style_hatching
  SUBTYPE OF (geometric_representation_item);
  hatch_line_appearance      : curve_style;
  start_of_next_hatch_line   : one_direction_repeat_factor;
  point_of_reference_hatch_line : cartesian_point;
  pattern_start               : cartesian_point;
  hatch_line_angle            : plane_angle_measure;
END_ENTITY; -- fill_area_style_hatching

ENTITY fill_area_style_tile_symbol_with_style
  SUBTYPE OF (geometric_representation_item);
  symbol : annotation_symbol_occurrence;
END_ENTITY; -- fill_area_style_tile_symbol_with_style

ENTITY fill_area_style_tiles
  SUBTYPE OF (geometric_representation_item);

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tiling_pattern : two_direction_repeat_factor;
tiles          : SET [1:?] OF fill_area_style_tile_shape_select;
tiling_scale   : positive_ratio_measure;
END_ENTITY; -- fill_area_style_tiles

ENTITY geometric_representation_context
  SUBTYPE OF (representation_context);
    coordinate_space_dimension : dimension_count;
END_ENTITY; -- geometric_representation_context

ENTITY geometric_representation_item
  SUPERTYPE OF (ONEOF (point,direction,vector,placement,curve))
  SUBTYPE OF (representation_item);
  DERIVE
    dim : dimension_count := dimension_of(SELF);
  WHERE
    wr1: SIZEOF(QUERY ( using_rep <* using_representations(SELF) | (NOT
      ('PLANT_FUNCTIONAL_DATA.GEOMETRIC_REPRESENTATION_CONTEXT' IN
      TYPEOF(using_rep.context_of_items)))) ) = 0;
END_ENTITY; -- geometric_representation_item

ENTITY global_unit_assigned_context
  SUBTYPE OF (representation_context);
    units : SET [1:?] OF unit;
END_ENTITY; -- global_unit_assigned_context

ENTITY graphical_transformation
  SUBTYPE OF (item_defined_transformation);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.AXIS2_PLACEMENT_2D' IN TYPEOF(SELF \
      item_defined_transformation.transform_item_1);
    wr2: 'PLANT_FUNCTIONAL_DATA.PRESENTATION_SCALED_PLACEMENT' IN
      TYPEOF(SELF\item_defined_transformation.transform_item_2);
END_ENTITY; -- graphical_transformation

ENTITY group;
  name       : label;
  description : text;
END_ENTITY; -- group

ENTITY group_assignment
  ABSTRACT SUPERTYPE;
  assigned_group : group;
  role          : group_role;
END_ENTITY; -- group_assignment

ENTITY group_relationship;
  name       : label;
  description : text;

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        relating_group : group;
        related_group  : group;
END_ENTITY; -- group_relationship

ENTITY group_role;
    name          : label;
    description   : text;
END_ENTITY; -- group_role

ENTITY hyperbola
    SUBTYPE OF (conic);
    semi_axis      : positive_length_measure;
    semi_imag_axis : positive_length_measure;
END_ENTITY; -- hyperbola

ENTITY identification_assignment
    ABSTRACT SUPERTYPE;
    assigned_id : identifier;
    role        : identification_role;
END_ENTITY; -- identification_assignment

ENTITY identification_role;
    name          : label;
    description   : text;
END_ENTITY; -- identification_role

ENTITY information_content_representation
    SUBTYPE OF (representation);
    WHERE
        wr1: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(TYPEOF(item *
            [ 'PLANT_FUNCTIONAL_DATA.DESCRIPTIVE REPRESENTATION_ITEM',
            'PLANT_FUNCTIONAL_DATA.MEASURE_REPRESENTATION_ITEM',
            'PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_NUMERIC_OPERATOR',
            'PLANT_FUNCTIONAL_DATA.' +
            'EXTERNALLY_DEFINED_REPRESENTATION_ITEM'])) >= 1)) )) = 0;
        wr2: SELF.context_of_items.context_type = 'information content';
END_ENTITY; -- information_content_representation

ENTITY inheritance_effectivity
    SUBTYPE OF (product_definition_effectivity);
    WHERE
        wr1: SELF\product_definition_effectivity.usage.
            relating_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence',
            'physical definition','physical occurrence'];
        wr2: SELF\product_definition_effectivity.usage.
            related_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence',
            'physical definition','physical occurrence'];

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wr3: SIZEOF(TYPEOF(SELF.usage) * [
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_VERSION',
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_ALTERNATIVE',
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_DERIVATION']) = 1;
END_ENTITY; -- inheritance_effectivity

ENTITY invisibility;
    invisible_items : SET [1:?] OF invisible_item;
END_ENTITY; -- invisibility

ENTITY involvement_in_activity_class_constraint
    SUBTYPE OF (group_relationship);
    WHERE
        wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF.
            relating_group);
        wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INVESTIGATION' IN TYPEOF(SELF.
            related_group);
END_ENTITY; -- involvement_in_activity_class_constraint

ENTITY involvement_in_activity_class_constraint_group
    SUBTYPE OF (involvement_in_activity_class_constraint, group);
    WHERE
        wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
            'PLANT_FUNCTIONAL_INVESTIGATION_OF' +
            'OBJECT_IN_ACTIVITY_CLASS_CONSTRAINT' +
            'ASSIGNMENT.ASSIGNED_GROUP')) >= 1;
END_ENTITY; -- involvement_in_activity_class_constraint_group

ENTITY item_defined_transformation;
    name          : label;
    description   : text;
    transform_item_1 : representation_item;
    transform_item_2 : representation_item;
END_ENTITY; -- item_defined_transformation

ENTITY leader_curve
    SUBTYPE OF (annotation_curve_occurrence);
    WHERE
        wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
            'LEADER_DIRECTED_CALLOUT.CONTENTS')) >= 1;
END_ENTITY; -- leader_curve

ENTITY leader_directed_callout
    SUBTYPE OF (draughting_callout);
    WHERE
        wr1: SIZEOF(QUERY ( l_1 <* SELF\draughting_callout.contents | (
            'PLANT_FUNCTIONAL_DATA.LEADER_CURVE' IN TYPEOF(l_1))) ) >= 1;
        wr2: SIZEOF(SELF\draughting_callout.contents) >= 2;
END_ENTITY; -- leader_directed_callout

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ENTITY leader_terminator
  SUBTYPE OF (terminator_symbol);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.LEADER_CURVE' IN TYPEOF(SELF \
      terminator_symbol.annotated_curve);
END_ENTITY; -- leader_terminator

ENTITY length_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.LENGTH_UNIT' IN TYPEOF(SELF \
      measure_with_unit.unit_component);
END_ENTITY; -- length_measure_with_unit

ENTITY length_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 1) AND (SELF\
      named_unit.dimensions.mass_exponent = 0) AND (SELF\
      named_unit.dimensions.time_exponent = 0) AND (SELF\
      named_unit.dimensions.electric_current_exponent = 0) AND (
      SELF\named_unit.dimensions.
      thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
      .dimensions.amount_of_substance_exponent = 0) AND (SELF\
      named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- length_unit

ENTITY library_assignment
  ABSTRACT SUPERTYPE
  SUBTYPE OF (external_referent_assignment);
    frame_of_reference : library_context;
  UNIQUE
    url : frame_of_reference;
END_ENTITY; -- library_assignment

ENTITY library_context
  SUBTYPE OF (application_context_element);
    library_reference : label;
END_ENTITY; -- library_context

ENTITY line
  SUBTYPE OF (curve);
    pnt : cartesian_point;
    dir : vector;
  WHERE
    wr1: dir.dim = pnt.dim;
END_ENTITY; -- line
```

```

ENTITY local_time;
  hour_component : hour_in_day;
  minute_component : OPTIONAL minute_in_hour;
  second_component : OPTIONAL second_in_minute;
  zone           : coordinated_universal_time_offset;
WHERE
  wr1: valid_time(SELF);
END_ENTITY; -- local_time

ENTITY luminous_intensity_measure_with_unit
  SUBTYPE OF (measure_with_unit);
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.LUMINOUS_INTENSITY_UNIT' IN TYPEOF(SELF \
    measure_with_unit.unit_component);
END_ENTITY; -- luminous_intensity_measure_with_unit

ENTITY luminous_intensity_unit
  SUBTYPE OF (named_unit);
WHERE
  wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF \
    named_unit.dimensions.mass_exponent = 0) AND (SELF \
    named_unit.dimensions.time_exponent = 0) AND (SELF \
    named_unit.dimensions.electric_current_exponent = 0) AND ( \
    SELF\named_unit.dimensions \
    thermodynamic_temperature_exponent = 0) AND (SELF\named_unit \
    .dimensions.amount_of_substance_exponent = 0) AND (SELF \
    named_unit.dimensions.luminous_intensity_exponent = 1);
END_ENTITY; -- luminous_intensity_unit

ENTITY mapped_item
  SUBTYPE OF (representation_item);
  mapping_source : representation_map;
  mapping_target : representation_item;
WHERE
  wr1: acyclic_mapped_representation(using_representations(SELF), [SELF]);
END_ENTITY; -- mapped_item

ENTITY mass_measure_with_unit
  SUBTYPE OF (measure_with_unit);
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.MASS_UNIT' IN TYPEOF(SELF \
    measure_with_unit.unit_component);
END_ENTITY; -- mass_measure_with_unit

ENTITY mass_unit
  SUBTYPE OF (named_unit);
WHERE
  wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF \

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        named_unit.dimensions.mass_exponent = 1) AND (SELF \
named_unit.dimensions.time_exponent = 0) AND (SELF \
named_unit.dimensions.electric_current_exponent = 0) AND (
SELF\named_unit.dimensions.
thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
.dimensions.amount_of_substance_exponent = 0) AND (SELF\
named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- mass_unit

ENTITY measure_representation_item
  SUBTYPE OF (representation_item, measure_with_unit);
END_ENTITY; -- measure_representation_item

ENTITY measure_with_unit
  SUPERTYPE OF (ONEOF (length_measure_with_unit, mass_measure_with_unit,
    time_measure_with_unit, electric_current_measure_with_unit,
    thermodynamic_temperature_measure_with_unit,
    amount_of_substance_measure_with_unit,
    luminous_intensity_measure_with_unit, plane_angle_measure_with_unit,
    solid_angle_measure_with_unit, area_measure_with_unit,
    volume_measure_with_unit, ratio_measure_with_unit));
  value_component : measure_value;
  unit_component   : unit;
  WHERE
    wr1: valid_units(SELF);
END_ENTITY; -- measure_with_unit

ENTITY name_assignment
  ABSTRACT SUPERTYPE;
  assigned_name : label;
  role          : name_role;
END_ENTITY; -- name_assignment

ENTITY name_role;
  name          : label;
  description   : text;
END_ENTITY; -- name_role

ENTITY named_unit
  SUPERTYPE OF (ONEOF (si_unit, conversion_based_unit,
    expression_conversion_based_unit, context_dependent_unit) ANDOR
    ONEOF (length_unit, mass_unit, time_unit, electric_current_unit,
    thermodynamic_temperature_unit, amount_of_substance_unit,
    luminous_intensity_unit, plane_angle_unit, solid_angle_unit, area_unit,
    volume_unit, ratio_unit));
  dimensions : dimensional_exponents;
END_ENTITY; -- named_unit

```

```

ENTITY next_assembly_usage_occurrence
  SUBTYPE OF (assembly_component_usage);
END_ENTITY; -- next_assembly_usage_occurrence

ENTITY offset_curve_2d
  SUBTYPE OF (curve);
  basis_curve      : curve;
  distance         : length_measure;
  self_intersect   : LOGICAL;
  WHERE
    wr1: basis_curve.dim = 2;
END_ENTITY; -- offset_curve_2d

ENTITY one_direction_repeat_factor
  SUBTYPE OF (geometric_representation_item);
  repeat_factor : vector;
END_ENTITY; -- one_direction_repeat_factor

ENTITY organization;
  id          : OPTIONAL identifier;
  name        : label;
  description : text;
END_ENTITY; -- organization

ENTITY organization_assignment
  ABSTRACT SUPERTYPE;
  assigned_organization : organization;
  role                  : organization_role;
END_ENTITY; -- organization_assignment

ENTITY organization_relationship;
  name          : label;
  description    : text;
  relating_organization : organization;
  related_organization : organization;
END_ENTITY; -- organization_relationship

ENTITY organization_role;
  name          : label;
  description    : text;
END_ENTITY; -- organization_role

ENTITY organizational_address
  SUBTYPE OF (address);
  organizations : SET [1:?] OF organization;
  description   : text;
END_ENTITY; -- organizational_address

ENTITY orientation_of_material
  SUBTYPE OF (shape_aspect, shape_aspect_relationship);
END_ENTITY; -- orientation_of_material

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ENTITY orientation_of_resource_for_facility
    SUBTYPE OF (shape_aspect, shape_aspect_relationship);
END_ENTITY; -- orientation_of_resource_for_facility

ENTITY page_connector
    SUBTYPE OF (annotation_occurrence);
END_ENTITY; -- page_connector

ENTITY parabola
    SUBTYPE OF (conic);
    focal_dist : length_measure;
    WHERE
        wr1: focal_dist <> 0;
END_ENTITY; -- parabola

ENTITY person;
    id          : identifier;
    last_name   : OPTIONAL label;
    first_name  : OPTIONAL label;
    middle_names : OPTIONAL LIST [1:?] OF label;
    prefix_titles : OPTIONAL LIST [1:?] OF label;
    suffix_titles : OPTIONAL LIST [1:?] OF label;
    WHERE
        wr1: EXISTS(last_name) OR EXISTS(first_name);
END_ENTITY; -- person

ENTITY person_and_organization;
    name         : label;
    description  : text;
    the_person   : person;
    the_organization : organization;
END_ENTITY; -- person_and_organization

ENTITY person_assignment
    ABSTRACT SUPERTYPE;
    assigned_person : person;
    role           : person_role;
END_ENTITY; -- person_assignment

ENTITY person_role;
    name         : label;
    description  : text;
END_ENTITY; -- person_role

ENTITY personal_address
    SUBTYPE OF (address);
    people      : SET [1:?] OF person;
    description : text;
END_ENTITY; -- personal_address
```

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ENTITY phase_of_material
  SUBTYPE OF (class_of_material);
END_ENTITY; -- phase_of_material

ENTITY placed_effectivity
  SUBTYPE OF (effectivity, characterized_object);
  WHERE
    wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION.DEFINITION')) = 1;
    wr2: SIZEOF(QUERY ( pd <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION.' + 'DEFINITION') | (NOT (SIZEOF(
      USEDIN(pd,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION_REPRESENTATION.' + 'DEFINITION')) = 1)) )) =
      0;
    wr3: SIZEOF(QUERY ( pd <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION.' + 'DEFINITION') | (NOT (SIZEOF(
      QUERY ( pdr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION_' + 'REPRESENTATION.DEFINITION') | (
      NOT (SIZEOF(pdr.used_representation.items = 1) AND (
      'PLANT_FUNCTIONAL_DATA.POINT' IN TYPEOF(pdr.
      used_representation.items[1])))) = 0))) ) = 0));
END_ENTITY; -- placed_effectivity

ENTITY placement
  SUPERTYPE OF (axis2_placement_2d)
  SUBTYPE OF (geometric_representation_item);
    location : cartesian_point;
END_ENTITY; -- placement

ENTITY planar_box
  SUBTYPE OF (planar_extent);
    placement : axis2_placement;
END_ENTITY; -- planar_box

ENTITY planar_extent
  SUBTYPE OF (geometric_representation_item);
    size_in_x : length_measure;
    size_in_y : length_measure;
END_ENTITY; -- planar_extent

ENTITY plane_angle_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.PLANE_ANGLE_UNIT' IN TYPEOF(SELF \
      measure_with_unit.unit_component);
END_ENTITY; -- plane_angle_measure_with_unit

ENTITY plane_angle_unit
  SUBTYPE OF (named_unit);

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WHERE
wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
    named_unit.dimensions.mass_exponent = 0) AND (SELF\
    named_unit.dimensions.time_exponent = 0) AND (SELF\
    named_unit.dimensions.electric_current_exponent = 0) AND ((
    SELF\named_unit.dimensions.
    thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
    .dimensions.amount_of_substance_exponent = 0) AND (SELF\
    named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- plane_angle_unit

ENTITY plant_functional_action_identification_context_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF identification_context_item;
WHERE
    wr1: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(USEDIN(item,
        'PLANT_FUNCTIONAL_DATA.' + 'EXTERNAL_IDENTIFICATION.SOURCE'))
        >= 1)) )) = 0;
END_ENTITY; -- plant_functional_action_identification_context_assignment

ENTITY plant_functional_activity_input_information_content_class_constraint_as
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF
        input_output_information_content_description_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\
        group_assignment.assigned_group);
END_ENTITY; --
plant_functional_activity_input_information_content_class_constraint_assignment

ENTITY plant_functional_activity_input_information_content_constraint_assignme
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF
        input_output_information_content_description_item;
END_ENTITY; -- plant_functional_activity_input_information_content_constraint_

ENTITY plant_functional_activity_input_property_class_constraint_assignment
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF input_output_property_possession_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\
        group_assignment.assigned_group);
END_ENTITY; -- plant_functional_activity_input_property_class_constraint_assig

ENTITY plant_functional_activity_input_property_constraint_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF input_output_property_possession_item;
END_ENTITY; -- plant_functional_activity_input_property_constraint_assignment

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ENTITY plant_functional_activity_output_information_content_class_constraint_a
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF
        input_output_information_content_description_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\
        group_assignment.assigned_group);
END_ENTITY; --
plant_functional_activity_output_information_content_class_constraint_assignment

ENTITY plant_functional_activity_output_information_content_constraint_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF
        input_output_information_content_description_item;
END_ENTITY; -- plant_functional_activity_output_information_content_constraint_assignment

ENTITY plant_functional_activity_output_property_class_constraint_assignment
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF input_output_property_possession_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\
        group_assignment.assigned_group);
END_ENTITY; -- plant_functional_activity_output_property_class_constraint_assignment

ENTITY plant_functional_activity_output_property_constraint_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF input_output_property_possession_item;
END_ENTITY; -- plant_functional_activity_output_property_constraint_assignment

ENTITY plant_functional_activity_performer_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF activity_performer_item;
WHERE
    wr1: SIZEOF(QUERY ( pd <* QUERY ( item <* SELF.items | (
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(item)) )
        | (NOT (pd\product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence',
            'physical definition','physical occurrence'])) ) ) = 0;
END_ENTITY; -- plant_functional_activity_performer_assignment

ENTITY plant_functional_approval_assignment
SUBTYPE OF (approval_assignment);
    items : SET [1:?] OF approval_item;
WHERE
    wr1: SELF.role.description IN ['actual','intended'];
END_ENTITY; -- plant_functional_approval_assignment

ENTITY plant_functional_approval_effectivity_assignment
SUBTYPE OF (effectivity_assignment);

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    items : SET [1:?] OF approval_effectivity_item;
WHERE
    wr1: ('PLANT_FUNCTIONAL_DATA.' +
           'PROCESS_OR_PROCESS_RELATIONSHIP_EFFECTIVITY') IN TYPEOF(
               SELF.assigned_effectivity);
END_ENTITY; -- plant_functional_approval_effectivity_assignment

ENTITY plant_functional_assessed_object_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF approval_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
                                              assigned_action,'PLANT_FUNCTIONAL_DATA.' +
                                              'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS')) | (('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                              TYPEOF(act\group_assignment.assigned_group)) AND (act\group_assignment.assigned_group.name = 'Assess'))) ) +
           SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
                                              assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
                                              'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS')) | (('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                              TYPEOF(acm\group_assignment.assigned_group)) AND (acm\group_assignment.assigned_group.name = 'Assess'))) )) = 1;
END_ENTITY; -- plant_functional_assessed_object_activity_assignment

ENTITY plant_functional_assessment_purpose_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF assessment_purpose_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
                                              assigned_action,'PLANT_FUNCTIONAL_DATA.' +
                                              'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS')) | (('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                              TYPEOF(act\group_assignment.assigned_group)) AND (act\group_assignment.assigned_group.name = 'Assess'))) ) +
           SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
                                              assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
                                              'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS')) | (('PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
                                              TYPEOF(acm\group_assignment.assigned_group)) AND (acm\group_assignment.assigned_group.name = 'Assess'))) )) = 1;
END_ENTITY; -- plant_functional_assessment_purpose_activity_assignment

ENTITY plant_functional_assessment_result_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF assessment_result_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.

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        assigned_action,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(act\group_assignment.assigned_group)) AND (act\
        group_assignment.assigned_group.name = 'Assess')) ) + +
        SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
        assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
        group_assignment.assigned_group.name = 'Assess')) ))) = 1;
END_ENTITY; -- plant_functional_assessment_result_activity_assignment

ENTITY plant_functional_class_of_activity_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF class_of_activity_item;
END_ENTITY; -- plant_functional_class_of_activity_assignment

ENTITY plant_functional_class_of_annotation_element_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF annotation_element_item;
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ANNOTATION_ELEMENT' IN TYPEOF(
    SELF.assigned_group);
END_ENTITY; -- plant_functional_class_of_annotation_element_assignment

ENTITY plant_functional_class_of_annotation_element_library_assignment
  SUBTYPE OF (library_assignment);
    items : SET [1:?] OF class_of_annotation_element_library_item;
WHERE
  wr1: SELF.frame_of_reference.library_reference =
    'class of annotation element library';
END_ENTITY; -- plant_functional_class_of_annotation_element_library_assignment

ENTITY plant_functional_class_of_facility_library_assignment
  SUBTYPE OF (library_assignment);
    items : SET [1:?] OF class_of_facility_library_item;
WHERE
  wr1: SELF.frame_of_reference.library_reference =
    'class of facility library';
END_ENTITY; -- plant_functional_class_of_facility_library_assignment

ENTITY plant_functional_class_of_information_content_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF information_content_item;
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT' IN TYPEOF(
    SELF.assigned_group);

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wr2: SIZEOF(QUERY ( i <* SELF.items | (NOT (i\representation_context
    .context_type = 'information content')) )) = 0;
END_ENTITY; -- plant_functional_class_of_information_content_assignment

ENTITY plant_functional_class_of_information_content_library_assignment
    SUBTYPE OF (library_assignment);
        items : SET [1:?] OF class_of_information_content_library_item;
WHERE
    wr1: SELF.frame_of_reference.library_reference =
        'class of information content library';
END_ENTITY; -- plant_functional_class_of_information_content_library_assignment

ENTITY plant_functional_class_of_information_held_by_information_carrier_assignment
    SUBTYPE OF (group_assignment);
        items : SET [1:?] OF information_carrier_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT' IN TYPEOF(
        SELF.assigned_group);
    wr2: SIZEOF(QUERY ( i <* SELF.items | (NOT ((i\product_definition.
            frame_of_reference\application_context_element.name IN [
                'functional definition','functional occurrence',
                'physical definition','physical occurrence']) AND (i\
            product_definition.frame_of_reference\
            application_context_element.frame_of_reference[1].name =
                'information holder')))) = 0;
END_ENTITY; --
plant_functional_class_of_information_held_by_information_carrier_assignment

ENTITY plant_functional_class_of_involvement_assignment
    SUBTYPE OF (group_assignment);
        items : SET [1:?] OF class_of_involvement_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INVESTIGATION' IN TYPEOF(SELF.
        assigned_group);
    wr2: SIZEOF(QUERY ( pfoa <* QUERY ( item <* SELF.items |
        ('PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_ORGANIZATION_ASSIGNMENT'
            IN TYPEOF(item)) ) | (NOT (SIZEOF(QUERY ( org_item <* pfoa.
                items | (NOT ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN
                    TYPEOF(org_item)))) )) = 0)) ) = 0;
    wr3: SIZEOF(QUERY ( pfpa <* QUERY ( item <* SELF.items |
        'PLANT_FUNCTIONAL_DATA.PLANT_FUNCTIONAL_PERSON_ASSIGNMENT'
            IN TYPEOF(item)) ) | (NOT (SIZEOF(QUERY ( per_item <* pfpa.
                items | (NOT ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN
                    TYPEOF(per_item)))) )) = 0)) ) = 0;
END_ENTITY; -- plant_functional_class_of_involvement_assignment

ENTITY plant_functional_class_of_material_library_assignment
    SUBTYPE OF (library_assignment);

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    items : SET [1:?] OF class_of_material_library_item;
WHERE
    wr1: SELF.frame_of_reference.library_reference =
          'class of material library';
END_ENTITY; -- plant_functional_class_of_material_library_assignment

ENTITY plant_functional_class_of_object_description_constraint_assignment
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF described_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INFORMATION_CONTENT' IN TYPEOF(
          SELF.assigned_group);
END_ENTITY; -- plant_functional_class_of_object_description_constraint_assignment

ENTITY plant_functional_class_of_property_library_assignment
SUBTYPE OF (library_assignment);
    items : SET [1:?] OF class_of_property_library_item;
WHERE
    wr1: SELF.frame_of_reference.library_reference =
          'class of property library';
END_ENTITY; -- plant_functional_class_of_property_library_assignment

ENTITY plant_functional_context_for_hierarchy_action_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF hierarchy_context_item;
WHERE
    wr1: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(
          QUERY ( pdr <* USEDIN(item,
          'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
          'RELATING_PRODUCT_DEFINITION') | (
          'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN
          TYPEOF(pdr)) )) >= 1)) )) = 0;
END_ENTITY; -- plant_functional_context_for_hierarchy_action_assignment

ENTITY plant_functional_context_for_hierarchy_group_assignment
SUBTYPE OF (group_assignment);
    items : SET [1:?] OF hierarchy_context_item;
WHERE
    wr1: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(
          QUERY ( pdr <* USEDIN(item,
          'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
          'RELATING_PRODUCT_DEFINITION') | (
          'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN
          TYPEOF(pdr)) )) >= 1)) )) = 0;
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\
          group_assignment.assigned_group);
END_ENTITY; -- plant_functional_context_for_hierarchy_group_assignment

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ENTITY plant_functional_context_for_hierarchy_organization_assignment
SUBTYPE OF (organization_assignment);
    items : SET [1:?] OF hierarchy_context_item;
WHERE
    wr1: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(
        QUERY ( pdr <* USEDIN(item,
            'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
            'RELATING_PRODUCT_DEFINITION') | (
                'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN
                TYPEOF(pdr)) ) >= 1))) ) = 0;
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF\organization_assignment.assigned_organization);
END_ENTITY; -- plant_functional_context_for_hierarchy_organization_assignment

ENTITY plant_functional_data_record_name_assignment
SUBTYPE OF (name_assignment);
    items : SET [1:?] OF named_item;
END_ENTITY; -- plant_functional_data_record_name_assignment

ENTITY plant_functional_design_reference_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF design_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
        assigned_action,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
            'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
            TYPEOF(act\group_assignment.assigned_group)) AND (act\group_assignment.assigned_group.name = 'Design')) ) + SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
        assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
            'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
            TYPEOF(acm\group_assignment.assigned_group)) AND (acm\group_assignment.assigned_group.name = 'Design')) ))) = 1;
END_ENTITY; -- plant_functional_design_reference_activity_assignment

ENTITY plant_functional_design_result_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF design_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
        assigned_action,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
            'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
            TYPEOF(act\group_assignment.assigned_group)) AND (act\group_assignment.assigned_group.name = 'Design')) ) + SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.

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        assigned_action.chosen_method, 'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
        group_assignment.assigned_group.name = 'Design')) )) ) = 1;
END_ENTITY; -- plant_functional_design_result_activity_assignment

ENTITY plant_functional_effectivity_assignment
  SUBTYPE OF (effectivity_assignment);
    items : SET [1:?] OF effectivity_item;
  WHERE
    wr1: SELF.assigned_effectivity.id IN ['beginning', 'end'];
END_ENTITY; -- plant_functional_effectivity_assignment

ENTITY plant_functional_enumerated_property_in_class_of_property_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF class_of_property_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN TYPEOF(SELF.
      assigned_group);
    wr2: SIZEOF(QUERY ( prop <* QUERY ( item <* SELF.items | (
      'PLANT_FUNCTIONAL_DATA.PROPERTY_DEFINITION' IN TYPEOF(item)) )
      | (NOT (SIZEOF(USEDIN(prop,'PLANT_FUNCTIONAL_DATA.' +
      'PROPERTY_DEFINITION_REPRESENTATION.DEFINITION')) > 0)) )) = 0;
    wr3: SIZEOF(QUERY ( prop <* QUERY ( item <* SELF.items | (
      'PLANT_FUNCTIONAL_DATA.ACTION_PROPERTY' IN TYPEOF(item)) )
      | (NOT (SIZEOF(USEDIN(prop,'PLANT_FUNCTIONAL_DATA.' +
      'ACTION_DEFINITION_REPRESENTATION.PROPERTY')) > 0)) )) = 0;
END_ENTITY; -- plant_functional_enumerated_property_in_class_of_property_assignment

ENTITY plant_functional_group_identification_context_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF identification_context_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_ACTIVITY' IN TYPEOF(SELF.
      assigned_group);
    wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT (SIZEOF(USEDIN(item,
      'PLANT_FUNCTIONAL_DATA.' + 'EXTERNAL_IDENTIFICATION.SOURCE')) =
      1)) )) = 0;
END_ENTITY; -- plant_functional_group_identification_context_assignment

ENTITY plant_functional_identification_assignment
  SUBTYPE OF (identification_assignment);
    item : identified_item;
END_ENTITY; -- plant_functional_identification_assignment

ENTITY plant_functional_information_carrier_definition_assignment
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SUBTYPE OF (
    plant_functional_information_carrier_description_assignment);
END_ENTITY; -- plant_functional_information_carrier_definition_assignment

ENTITY plant_functional_information_carrier_description_assignment
    SUPERTYPE OF (ONEOF (
        plant_functional_information_carrier_definition_assignment,
        plant_functional_information_carrier_reference_assignment))
    SUBTYPE OF (document_reference);
    items : SET [1:?] OF described_item;
WHERE
    wr1: SIZEOF(USEDIN(SELF\document_reference.assigned_document,
        'PLANT_FUNCTIONAL_SCHEMA.PRODUCT_DEFINITION_' +
        'WITH_ASSOCIATED_DOCUMENTS.DOCUMENTATION_IDS')) >= 1;
END_ENTITY; -- plant_functional_information_carrier_description_assignment

ENTITY plant_functional_information_carrier_reference_assignment
    SUPERTYPE OF (
        plant_functional_information_carrier_definition_assignment);
END_ENTITY; -- plant_functional_information_carrier_reference_assignment

ENTITY plant_functional_information_content_definition_assignment
    SUPERTYPE OF (
        plant_functional_information_content_description_assignment);
END_ENTITY; -- plant_functional_information_content_definition_assignment

ENTITY plant_functional_information_content_description_assignment
    SUPERTYPE OF (ONEOF (
        plant_functional_information_content_definition_assignment,
        plant_functional_information_content_reference_assignment))
    SUBTYPE OF (document_reference);
    items : SET [1:?] OF described_item;
WHERE
    wr1: SIZEOF(USEDIN(SELF\document_reference.assigned_document,
        'PLANT_FUNCTIONAL_SCHEMA.PRODUCT_DEFINITION_' +
        'WITH_ASSOCIATED_DOCUMENTS.DOCUMENTATION_IDS')) >= 1;
END_ENTITY; -- plant_functional_information_content_description_assignment

ENTITY plant_functional_information_content_reference_assignment
    SUPERTYPE OF (
        plant_functional_information_content_description_assignment);
END_ENTITY; -- plant_functional_information_content_reference_assignment

ENTITY plant_functional_inheritance_exclusion_assignment
    SUPERTYPE OF (effectivity_assignment);
    items : SET [1:?] OF inherited_item;
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.INHERITANCE_EFFECTIVITY' IN TYPEOF(SELF.
        assigned_effectivity);
END_ENTITY; -- plant_functional_inheritance_exclusion_assignment

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ENTITY plant_functional_inheritance_inclusion_assignment
SUBTYPE OF (effectivity_assignment);
  items : SET [1:?] OF inherited_item;
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.INHERITANCE_EFFECTIVITY' IN TYPEOF(SELF.
    assigned_effectivity);
END_ENTITY; -- plant_functional_inheritance_inclusion_assignment

ENTITY plant_functional_involvement_constraint_assignment
SUBTYPE OF (group_assignment);
  items : SET [1:?] OF involved_class_item;
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_INVESTIGATION' IN TYPEOF(SELF.
    assigned_group);
END_ENTITY; -- plant_functional_involvement_constraint_assignment

ENTITY plant_functional_involvement_of_object_in_activity_class_constraint_assignment
SUBTYPE OF (group_assignment);
  items : SET [1:?] OF involved_class_item;
WHERE
  wr1: ('PLANT_FUNCTIONAL_DATA.' +
    'INVOLVEMENT_IN_ACTIVITY_CLASS_CONSTRAINT_GROUP') IN TYPEOF(
    SELF.assigned_group);
END_ENTITY; --
plant_functional_involvement_of_object_in_activity_class_constraint_assignment

ENTITY plant_functional_numeric_operator
SUBTYPE OF (qualified_representation_item);
WHERE
  wr1: SIZEOF(SELF.qualifiers) = 1;
  wr2: 'PLANT_FUNCTIONAL_DATA.TYPE_QUALIFIER' IN TYPEOF(SELF.
    qualifiers[1]);
  wr3: SELF.qualifiers[1]\type_qualifier.name IN ['=','>','>=','<',
    '<=','<>'];
END_ENTITY; -- plant_functional_numeric_operator

ENTITY plant_functional_organization_assignment
SUBTYPE OF (organization_assignment);
  items : SET [1:?] OF organization_item;
WHERE
  wr1: plant_functional_organization_correlation(SELF);
  wr2: SIZEOF(QUERY ( pd_item <* QUERY ( item <* SELF.items | (
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(item))
    AND (SELF.role.name = 'context for hierarchy')) ) | (NOT (
    SIZEOF(QUERY ( pdr <* USEDIN(pd_item,
      'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATING_PRODUCT_DEFINITION') | (
        'PLANT_FUNCTIONAL_DATA.SPECIFIED_HIGHER_USAGE_OCCURRENCE' IN

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        TYPEOF(pdr)) )) >= 1)) )) = 0;
wr3: SIZEOF(QUERY ( ex_item <* QUERY ( item <* SELF.items | (
    'PLANT_FUNCTIONAL_DATA.EXTERNAL_SOURCE' IN TYPEOF(item)) )
    | (NOT (SIZEOF(USEDIN(ex_item,'PLANT_FUNCTIONAL_DATA.' +
    'EXTERNAL_IDENTIFICATION.SOURCE')) >= 1)) )) = 0;
END_ENTITY; -- plant_functional_organization_assignment

ENTITY plant_functional_person_assignment
  SUBTYPE OF (person_assignment);
  items : SET [1:?] OF person_item;
WHERE
  wr1: plant_functional_person_correlation(SELF);
END_ENTITY; -- plant_functional_person_assignment

ENTITY plant_functional_presented_item
  SUBTYPE OF (presented_item);
  items : SET [1:?] OF item_for_presentation;
WHERE
  wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM')) >= 1;
  wr2: SIZEOF(QUERY ( pir <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM') | (NOT (SIZEOF(TYPEOF(
    pir.presentation) * [
      'PLANT_FUNCTIONAL_DATA.DRAWING_REVISION',
      'PLANT_FUNCTIONAL_DATA.PRESENTATION_AREA',
      'PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW'])) = 1)) )) = 0;
  wr3: SIZEOF(QUERY ( pd <* QUERY ( item <* SELF.items | (
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(item)) )
    | (NOT (pd\product_definition.frame_of_reference.name IN [
      'functional definition','functional occurrence',
      'physical definition','physical occurrence'])) )) = 0;
END_ENTITY; -- plant_functional_presented_item

ENTITY plant_functional_presented_item_with_association
  SUBTYPE OF (presented_item);
  items : SET [1:?] OF item_for_presentation;
WHERE
  wr1: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM')) >= 1;
  wr2: SIZEOF(QUERY ( pir <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTED_ITEM REPRESENTATION.ITEM') | (NOT (
    'PLANT_FUNCTIONAL_DATA.PRESENTATION_WITH_ASSOCIATION' IN
    TYPEOF(pir.presentation)))) ) = 0;
  wr3: SIZEOF(QUERY ( pd <* QUERY ( item <* SELF.items | (
    'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(item)) )
    | (NOT (pd\product_definition.frame_of_reference.name IN [
      'functional definition','functional occurrence',
      'physical definition','physical occurrence'])) )) = 0;

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END_ENTITY; -- plant_functional_presented_item_with_association

ENTITY plant_functional_property_classification_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF class_of_property_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN TYPEOF(SELF.
      assigned_group);
END_ENTITY; -- plant_functional_property_classification_assignment

ENTITY plant_functional_recognized_possession_of_property_assignment
  SUBTYPE OF (group_assignment);
    items : SET [1:?] OF possessed_class_of_property_item;
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_PROPERTY' IN TYPEOF(SELF.
      assigned_group);
END_ENTITY; -- plant_functional_recognized_possession_of_property_assignment

ENTITY plant_functional_symbol_library_assignment
  SUBTYPE OF (library_assignment);
    items : SET [1:?] OF symbol_library_item;
  WHERE
    wr1: SELF.frame_of_reference.library_reference =
      'library of symbols';
END_ENTITY; -- plant_functional_symbol_library_assignment

ENTITY plant_functional_transfer_material_destination_activity_assignment
  SUBTYPE OF (action_assignment);
    item : transfer_source_destination_item;
  WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
      assigned_action,'PLANT_FUNCTIONAL_DATA.' +
      'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
      'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF(act\group_assignment.assigned_group)) AND (act\
      group_assignment.assigned_group.name = 'Transfer_material')) )) +
    SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
      assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
      'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
      'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
      TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
      group_assignment.assigned_group.name = 'Transfer_material')) ))) =
    1;
    wr2: item\product_definition.frame_of_reference.name IN [
      'functional definition','functional occurrence',
      'physical definition','physical occurrence'];
END_ENTITY; -- plant_functional_transfer_material_destination_activity_assignment

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ENTITY plant_functional_transfer_material_source_activity_assignment
SUBTYPE OF (action_assignment);
    item : transfer_source_destination_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
        assigned_action,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(act\group_assignment.assigned_group)) AND (act\
        group_assignment.assigned_group.name = 'Transfer_material')) )) +
    SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
        assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
        group_assignment.assigned_group.name = 'Transfer_material')) )) ) =
    1;
    wr2: item\product_definition.frame_of_reference.name IN [
        'functional definition','functional occurrence',
        'physical definition','physical occurrence'];
END_ENTITY; -- plant_functional_transfer_material_source_activity_assignment

ENTITY plant_functional_transferred_material_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF transfer_material_item;
WHERE
    wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
        assigned_action,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(act\group_assignment.assigned_group)) AND (act\
        group_assignment.assigned_group.name = 'Transfer_material')) )) +
    SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
        assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
        'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
        'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
        TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
        group_assignment.assigned_group.name = 'Transfer_material')) )) ) =
    1;
    wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT (item\
        product_definition.frame_of_reference.frame_of_reference[1].name =
        'process material')) )) = 0;
END_ENTITY; -- plant_functional_transferred_material_activity_assignment

ENTITY plant_functional_transform_material_input_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF transform_material_item;

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WHERE
wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
    assigned_action,'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
    'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
    TYPEOF(act\group_assignment.assigned_group)) AND (act\
    group_assignment.assigned_group.name = 'Transfer_material')) ) )
+ SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
    assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
    'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
    TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
    group_assignment.assigned_group.name = 'Transfer_material')) ) )
= 1;
wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT (item\
    product_definition.frame_of_reference.frame_of_reference[1].
    name IN ['process material','physical information carrier'])) ) )
= 0;
END_ENTITY; -- plant_functional_transform_material_input_activity_assignment

ENTITY plant_functional_transform_material_output_activity_assignment
SUBTYPE OF (action_assignment);
    items : SET [1:?] OF transform_material_item;
WHERE
wr1: (SIZEOF(QUERY ( act <* USEDIN(SELF\action_assignment.
    assigned_action,'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
    'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
    TYPEOF(act\group_assignment.assigned_group)) AND (act\
    group_assignment.assigned_group.name = 'Transform_material')) ) )
+ SIZEOF(QUERY ( acm <* USEDIN(SELF\action_assignment.
    assigned_action.chosen_method,'PLANT_FUNCTIONAL_DATA.' +
    'PLANT_FUNCTIONAL_CLASS_OF_ACTIVITY_ASSIGNMENT.ITEMS') | (((
    'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN
    TYPEOF(acm\group_assignment.assigned_group)) AND (acm\
    group_assignment.assigned_group.name = 'Transform_material')) ) )
= 1;
wr2: SIZEOF(QUERY ( item <* SELF.items | (NOT (item\
    product_definition.frame_of_reference.frame_of_reference[1].
    name IN ['process material','physical information carrier'])) ) )
= 0;
END_ENTITY; -- plant_functional_transform_material_output_activity_assignment

ENTITY plant_functional_typical_facility_catalogue_assignment
SUBTYPE OF (library_assignment);
    items : SET [1:?] OF typical_facility_catalogue_item;
WHERE

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wr1: SELF.frame_of_reference.library_reference =
      'typical facility catalogue';
wr2: SIZEOF(QUERY ( p_d <* SELF.items | (NOT (p_d\product_definition
      .frame_of_reference.name = 'functional definition')) )) = 0;
END_ENTITY; -- plant_functional_typical_facility_catalogue_assignment

ENTITY plant_functional_typical_material_catalogue_assignment
  SUBTYPE OF (library_assignment);
    items : SET [1:?] OF typical_material_catalogue_item;
  WHERE
    wr1: SELF.frame_of_reference.library_reference =
          'typical material catalogue';
    wr2: SIZEOF(QUERY ( p_d <* SELF.items | (NOT (p_d\product_definition
          .frame_of_reference.name = 'physical definition')) )) = 0;
END_ENTITY; -- plant_functional_typical_material_catalogue_assignment

ENTITY point
  SUPERTYPE OF (ONEOF (cartesian_point,point_on_curve))
  SUBTYPE OF (geometric_representation_item);
END_ENTITY; -- point

ENTITY point_in_space_of_material
  SUBTYPE OF (shape_aspect, shape_aspect_relationship);
END_ENTITY; -- point_in_space_of_material

ENTITY point_in_space_of_resource_for_facility
  SUBTYPE OF (shape_aspect, shape_aspect_relationship);
END_ENTITY; -- point_in_space_of_resource_for_facility

ENTITY point_on_curve
  SUBTYPE OF (point);
    basis_curve      : curve;
    point_parameter : parameter_value;
END_ENTITY; -- point_on_curve

ENTITY polyline
  SUBTYPE OF (bounded_curve);
    points : LIST [2:?] OF cartesian_point;
END_ENTITY; -- polyline

ENTITY possession_of_facility_port
  SUBTYPE OF (product_definition_usage, product_definition);
  WHERE
    wr1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN [
        'functional definition','functional occurrence'];
    wr2: 'PLANT_FUNCTIONAL_DATA.FACILITY_PORT' IN TYPEOF(SELF\
      product_definition_relationship.related_product_definition);
END_ENTITY; -- possession_of_facility_port

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ENTITY possession_of_feature_connector
  SUBTYPE OF (annotation_occurrence_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'
      IN TYPEOF(SELF\annotation_occurrence_relationship.
      related_annotation_occurrence);
    wr2: NOT ('PLANT_FUNCTIONAL_DATA.CONNECTOR_FEATURE_ANNOTATION_OCCURRENCE'
      IN TYPEOF(SELF\annotation_occurrence_relationship.
      relating_annotation_occurrence));
  END_ENTITY; -- possession_of_feature_connector

ENTITY pre_defined_colour
  SUBTYPE OF (pre_defined_item, colour);
END_ENTITY; -- pre_defined_colour

ENTITY pre_defined_curve_font
  SUBTYPE OF (pre_defined_item);
END_ENTITY; -- pre_defined_curve_font

ENTITY pre_defined_item;
  name : label;
END_ENTITY; -- pre_defined_item

ENTITY pre_defined_symbol
  SUBTYPE OF (pre_defined_item);
END_ENTITY; -- pre_defined_symbol

ENTITY pre_defined_text_font
  SUBTYPE OF (pre_defined_item);
END_ENTITY; -- pre_defined_text_font

ENTITY presentation_area
  SUBTYPE OF (presentation_representation);
  WHERE
    wr1: (SIZEOF(QUERY ( ais <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'AREA_IN_SET.AREA') | (SIZEOF(USEDIN(ais,
      'PLANT_FUNCTIONAL_DATA.' + 'PRESENTATION_SIZE.UNIT')) = 1) )) >
      0) OR (SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PRESENTATION_SIZE.UNIT')) = 1);
  END_ENTITY; -- presentation_area

ENTITY presentation_layer_assignment;
  name          : label;
  description   : text;
  assigned_items : SET [1:?] OF layered_item;
END_ENTITY; -- presentation_layer_assignment

ENTITY presentation_layer_usage;
  assignment    : presentation_layer_assignment;

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presentation : presentation_representation;
UNIQUE
    url : assignment, presentation;
END_ENTITY; -- presentation_layer_usage

ENTITY presentation_representation
    SUBTYPE OF (representation);
    WHERE
        wr1: SELF\representation.context_of_items\
            geometric_representation_context.coordinate_space_dimension
            = 2;
        wr2: 'PLANT_FUNCTIONAL_DATA.GEOMETRIC_REPRESENTATION_CONTEXT' IN
            TYPEOF(SELF\representation.context_of_items);
END_ENTITY; -- presentation_representation

ENTITY presentation_representation_relationship
    SUBTYPE OF (representation_relationship_with_transformation);
    WHERE
        wr1: 'PLANT_FUNCTIONAL_DATA.PRESENTATION REPRESENTATION' IN TYPEOF(
            SELF\representation_relationship.rep_1);
        wr2: 'PLANT_FUNCTIONAL_DATA.PRESENTATION REPRESENTATION' IN TYPEOF(
            SELF\representation_relationship.rep_2);
        wr3: acyclic_presentation_representation_relationship(SELF,[SELF\
            representation_relationship.rep_2]);
        wr4: NOT (('PLANT_FUNCTIONAL_DATA.PRESENTATION_AREA' IN TYPEOF(SELF\
            representation_relationship.rep_1)) AND (NOT (SIZEOF([
            'PLANT_FUNCTIONAL_DATA.' +
            'PRODUCT_DATA_REPRESENTATION_VIEW', 'PLANT_FUNCTIONAL_DATA.' +
            'VIEW_DEPENDENT_ANNOTATION_REPRESENTATION'] * TYPEOF(SELF\
            representation_relationship.rep_2)) = 0)));
        wr5: NOT (('PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW' IN TYPEOF(SELF\
            representation_relationship.rep_1)) AND (NOT (SIZEOF([
            'PLANT_FUNCTIONAL_DATA.' + 'PRESENTATION_AREA',
            'PLANT_FUNCTIONAL_DATA.' + 'PRESENTATION_VIEW',
            'PLANT_FUNCTIONAL_DATA.' +
            'AREA_DEPENDENT_ANNOTATION_REPRESENTATION'] * TYPEOF(SELF\
            representation_relationship.rep_2)) = 0)));
        wr6: (NOT ('PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW' IN TYPEOF(SELF\
            representation_relationship.rep_2))) XOR (
            'PLANT_FUNCTIONAL_DATA.PRESENTATION_AREA' IN TYPEOF(SELF\
            representation_relationship.rep_1));
        wr7: (NOT (('PLANT_FUNCTIONAL_DATA.' +
            'PRODUCT_DATA_REPRESENTATION_VIEW') IN (TYPEOF(SELF\
            representation_relationship.rep_1) + TYPEOF(SELF\
            representation_relationship.rep_2)))) XOR ((((
            'PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW' IN TYPEOF(SELF\
            representation_relationship.rep_1)) AND (

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'PLANT_FUNCTIONAL_DATA.PRODUCT_DATA_REPRESENTATION_VIEW' IN
TYPEOF(SELF\representation_relationship.rep_2));
wr8: 'PLANT_FUNCTIONAL_DATA.GRAPHICAL_TRANSFORMATION' IN TYPEOF(SELF
\representation_relationship_with_transformation.
transformation_operator);
END_ENTITY; -- presentation_representation_relationship

ENTITY presentation_set;
    INVERSE
        areas : SET [1:?] OF area_in_set FOR in_set;
END_ENTITY; -- presentation_set

ENTITY presentation_size;
    unit : presentation_size_assignment_select;
    size : planar_box;
WHERE
    wr1: (('PLANT_FUNCTIONAL_DATA.PRESENTATION REPRESENTATION' IN
TYPEOF(SELF.unit)) AND item_in_context(SELF.size,SELF.unit\representation.context_of_items)) OR (((
'PLANT_FUNCTIONAL_DATA.AREA_IN_SET' IN TYPEOF(SELF.unit))
AND (SIZEOF(QUERY ( ais <* SELF.unit\area_in_set.in_set.
areas | (NOT item_in_context(SELF.size,ais.area\representation.context_of_items)) )) = 0)));
END_ENTITY; -- presentation_size

ENTITY presentation_style_assignment;
    styles : SET [1:?] OF presentation_style_select;
WHERE
    wr1: SIZEOF(QUERY ( style1 <* SELF.styles | (NOT (SIZEOF(
    QUERY ( style2 <* (SELF.styles - style1) | (NOT ((TYPEOF(
    style1) <> TYPEOF(style2))) OR (SIZEOF([
    'PLANT_FUNCTIONAL_DATA.' + 'SURFACE_STYLE_USAGE',
    'PLANT_FUNCTIONAL_DATA.' + 'EXTERNALLY_DEFINED_STYLE'] *
    TYPEOF(style1)) = 1)))) ) = 0)) ) = 0;
    wr2: SIZEOF(QUERY ( style1 <* SELF.styles | (
    'PLANT_FUNCTIONAL_DATA.SURFACE_STYLE_USAGE' IN TYPEOF(style1)) ))
    <= 2;
END_ENTITY; -- presentation_style_assignment

ENTITY presentation_view
    SUBTYPE OF (presentation_representation);
END_ENTITY; -- presentation_view

ENTITY presentation_view_with_clipping_box
    SUBTYPE OF (presentation_view);
WHERE
    wr1: SIZEOF(QUERY ( item <* SELF\representation.items | (((
    'PLANT_FUNCTIONAL_DATA.PLANAR_BOX' IN TYPEOF(item)) AND (

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        item\representation_item.name = 'clipping box')) )) = 1;
END_ENTITY; -- presentation_view_with_clipping_box

ENTITY presentation_with_association
  SUBTYPE OF (presentation_representation);
  WHERE
    wr1: SIZEOF(SELF\representation.items) = 1;
    wr2: 'PLANT_FUNCTIONAL_DATA.ANNOTATION_OCCURRENCE' IN TYPEOF(SELF\
      representation.items[1]);
    wr3: SIZEOF(USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PRESENTED_ITEM REPRESENTATION.PRESENTATION')) = 1;
    wr4: SIZEOF(QUERY ( pir <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PRESENTED_ITEM REPRESENTATION.PRESENTATION') | (NOT (((
      'PLANT_FUNCTIONAL_DATA.' +
      'PLANT_FUNCTIONAL_PRESENTED_ITEM_WITH_ASSOCIATION') IN
      TYPEOF(pir.item)))) ) = 0;
END_ENTITY; -- presentation_with_association

ENTITY presented_item
  ABSTRACT SUPERTYPE;
END_ENTITY; -- presented_item

ENTITY presented_item_representation;
  presentation : presentation_representation_select;
  item         : presented_item;
END_ENTITY; -- presented_item_representation

ENTITY process_or_process_relationship_effectivity
  SUBTYPE OF (effectivity);
  effective_process_or_process_relationship : process_or_process_relationship;
END_ENTITY; -- process_or_process_relationship_effectivity

ENTITY product;
  id           : identifier;
  name         : label;
  description   : text;
  frame_of_reference : SET [1:?] OF product_context;
END_ENTITY; -- product

ENTITY product_category;
  name         : label;
  description  : OPTIONAL text;
END_ENTITY; -- product_category

ENTITY product_category_relationship;
  name         : label;
  description  : text;
  category     : product_category;
  sub_category : product_category;

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WHERE
    wr1: acyclic_product_category_relationship(SELF,[SELF.sub_category]);
END_ENTITY; -- product_category_relationship

ENTITY product_context
    SUBTYPE OF (application_context_element);
        discipline_type : label;
END_ENTITY; -- product_context

ENTITY product_definition;
    id              : identifier;
    name            : label;
    description      : text;
    formation       : product_definition_formation;
    frame_of_reference : product_definition_context;
END_ENTITY; -- product_definition

ENTITY product_definition_alternative
    SUBTYPE OF (product_definition_relationship);
WHERE
    wr1: SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence',
            'physical definition','physical occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition
        .frame_of_reference.name IN ['functional definition',
            'functional occurrence','physical definition',
            'physical occurrence'];
    wr3: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence'])) OR (SELF\
product_definition_relationship.related_product_definition.
        frame_of_reference.name IN ['functional definition',
            'functional occurrence']);
    wr4: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'physical definition','physical occurrence'])) OR (SELF\
product_definition_relationship.related_product_definition.
        frame_of_reference.name IN ['physical definition',
            'physical occurrence']);
END_ENTITY; -- product_definition_alternative

ENTITY product_definition_context
    SUBTYPE OF (application_context_element);
        life_cycle_stage : label;
END_ENTITY; -- product_definition_context

ENTITY product_definition_derivation

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SUBTYPE OF (product_definition_relationship);
WHERE
    wr1: SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition', 'functional occurrence',
            'physical definition', 'physical occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition
        .frame_of_reference.name IN ['functional definition',
            'functional occurrence', 'physical definition',
            'physical occurrence'];
    wr3: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition', 'functional occurrence'])) OR (SELF\
            product_definition_relationship.related_product_definition.
            frame_of_reference.name IN ['functional definition',
            'functional occurrence']);
    wr4: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'physical definition', 'physical occurrence'])) OR (SELF\
            product_definition_relationship.related_product_definition.
            frame_of_reference.name IN ['physical definition',
            'physical occurrence']);
END_ENTITY; -- product_definition_derivation

ENTITY product_definition_effectivity
    SUBTYPE OF (effectivity);
        usage : product_definition_relationship;
    UNIQUE
        url : usage, id;
END_ENTITY; -- product_definition_effectivity

ENTITY product_definition_formation;
    id : identifier;
    description : text;
    of_product : product;
    UNIQUE
        url : id, of_product;
END_ENTITY; -- product_definition_formation

ENTITY product_definition_relationship;
    id : identifier;
    name : label;
    description : text;
    relating_product_definition : product_definition;
    related_product_definition : product_definition;
END_ENTITY; -- product_definition_relationship

ENTITY product_definition_shape
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SUBTYPE OF (property_definition);
UNIQUE
    url : definition;
WHERE
    wr1: NOT ('PLANT_FUNCTIONAL_DATA.SHAPE_DEFINITION' IN TYPEOF(SELF\
        property_definition.definition));
END_ENTITY; -- product_definition_shape

ENTITY product_definition_usage
    SUPERTYPE OF (assembly_component_usage)
    SUBTYPE OF (product_definition_relationship);
    UNIQUE
        url : id, relating_product_definition, related_product_definition;
WHERE
    wr1: acyclic_product_definition_relationship(SELF,[SELF\
        product_definition_relationship.related_product_definition],
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_USAGE.' +
        'RELATED_PRODUCT_DEFINITION');
END_ENTITY; -- product_definition_usage

ENTITY product_definition_version
    SUBTYPE OF (product_definition_relationship);
WHERE
    wr1: SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence',
            'physical definition','physical occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition.
        frame_of_reference.name IN ['functional definition',
            'functional occurrence','physical definition',
            'physical occurrence'];
    wr3: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence'])) OR (SELF\product_definition_relationship.related_product_definition.
        frame_of_reference.name IN ['functional definition',
            'functional occurrence']);
    wr4: (NOT (SELF\product_definition_relationship.
        relating_product_definition.frame_of_reference.name IN [
            'physical definition','physical occurrence'])) OR (SELF\product_definition_relationship.related_product_definition.
        frame_of_reference.name IN ['physical definition',
            'physical occurrence']);
END_ENTITY; -- product_definition_version

ENTITY product_definition_with_associated_documents
    SUBTYPE OF (product_definition);
    documentation_ids : SET [1:?] OF document;

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END_ENTITY; -- product_definition_with_associated_documents

ENTITY product_related_product_category
  SUBTYPE OF (product_category);
  products : SET [1:?] OF product;
END_ENTITY; -- product_related_product_category

ENTITY projection_curve
  SUBTYPE OF (annotation_curve_occurrence);
END_ENTITY; -- projection_curve

ENTITY projection_directed_callout
  SUBTYPE OF (draughting_callout);
  WHERE
    wr1: SIZEOF(QUERY ( p_1 <* SELF\draughting_callout.contents | (
      'PLANT_FUNCTIONAL_DATA.PROJECTION_CURVE' IN TYPEOF(p_1) ) ))
    = 1;
    wr2: SIZEOF(SELF\draughting_callout.contents) >= 2;
END_ENTITY; -- projection_directed_callout

ENTITY property_by_member
  SUBTYPE OF (property_definition);
  WHERE
    wr1: (NOT ('PLANT_FUNCTION_SCHEMA.PRODUCT_DEFINITION_RELATIONSHIP'
      IN TYPEOF(SELF.definition))) OR (SIZEOF(TYPEOF(SELF.
      definition) * [
        'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_MATERIAL',
        'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_FACILITY']) = 1);
    wr2: (NOT ('PLANT_FUNCTION_SCHEMA.PRODUCT_DEFINITION' IN TYPEOF(SELF
      .definition))) OR (SIZEOF(QUERY ( pdr <* USEDIN(SELF,
      'PLANT_FUNCTION_SCHEMA.' +
      'PRODUCT_DEFINITION_RELATIONSHIP.RELATING_PRODUCT_DEFINITION')
      | (SIZEOF(TYPEOF(pdr) * [
        'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_MATERIAL',
        'PLANT_FUNCTION_SCHEMA.COLLECTION_OF_FACILITY']) > 0) )) = 0);
END_ENTITY; -- property_by_member

ENTITY property_definition;
  name : label;
  description : text;
  definition : characterized_definition;
END_ENTITY; -- property_definition

ENTITY property_definition_alternative
  SUBTYPE OF (property_definition_relationship);
END_ENTITY; -- property_definition_alternative

ENTITY property_definition_derivation
  SUBTYPE OF (property_definition_relationship);
END_ENTITY; -- property_definition_derivation
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ENTITY property_definition_relationship;
  name          : label;
  description    : text;
  relating_property_definition : property_definition;
  related_property_definition : property_definition;
END_ENTITY; -- property_definition_relationship

ENTITY property_definition_representation;
  name          : label;
  description    : text;
  definition     : represented_definition;
  used_representation : representation;
END_ENTITY; -- property_definition_representation

ENTITY property_definition_version
  SUBTYPE OF (property_definition_relationship);
END_ENTITY; -- property_definition_version

ENTITY provision_of_service
  SUBTYPE OF (product_definition_relationship, product_definition);
  WHERE
    wr1: SELF.relating_product_definition.frame_of_reference.name IN [
      'functional definition', 'functional occurrence'];
    wr2: SELF.related_product_definition.frame_of_reference.name IN [
      'physical definition', 'physical occurrence'];
    wr3: (SELF.relating_product_definition.frame_of_reference.name <>
           'functional definition') OR (SELF.related_product_definition
           .frame_of_reference.name = 'physical definition');
    wr4: (SELF.relating_product_definition.frame_of_reference.name <>
           'functional occurrence') OR (SELF.related_product_definition
           .frame_of_reference.name = 'physical occurrence');
END_ENTITY; -- provision_of_service

ENTITY qualified_representation_item
  SUBTYPE OF (representation_item);
  qualifiers : SET [1:?] OF value_qualifier;
  WHERE
    wr1: SIZEOF(QUERY ( temp <* qualifiers | (
      'PLANT_FUNCTIONAL_DATA.PRECISION_QUALIFIER' IN TYPEOF(temp)) )) < 2;
END_ENTITY; -- qualified_representation_item

ENTITY quasi_uniform_curve
  SUBTYPE OF (b_spline_curve);
END_ENTITY; -- quasi_uniform_curve

ENTITY ratio_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE

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wr1: 'PLANT_FUNCTIONAL_DATA.RATIO_UNIT' IN TYPEOF(SELF \
    measure_with_unit.unit_component);
END_ENTITY; -- ratio_measure_with_unit

ENTITY ratio_unit
    SUBTYPE OF (named_unit);
    WHERE
        wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
            named_unit.dimensions.mass_exponent = 0) AND (SELF\
            named_unit.dimensions.time_exponent = 0) AND (SELF\
            named_unit.dimensions.electric_current_exponent = 0) AND (
            SELF\named_unit.dimensions.
            thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
            .dimensions.amount_of_substance_exponent = 0) AND (SELF\
            named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- ratio_unit

ENTITY rational_b_spline_curve
    SUBTYPE OF (b_spline_curve);
    weights_data : LIST [2:?] OF REAL;
    DERIVE
        weights : ARRAY [0:upper_index_on_control_points] OF REAL :=
            list_to_array(weights_data,0,
            upper_index_on_control_points);
    WHERE
        wr1: SIZEOF(weights_data) = SIZEOF(SELF\b_spline_curve.
            control_points_list);
        wr2: curve_weights_positive(SELF);
END_ENTITY; -- rational_b_spline_curve

ENTITY realization_of_intended_activity_by_actual
    SUBTYPE OF (action_relationship);
    WHERE
        wr1: SELF.relating_action.description = 'intended';
        wr2: SELF.related_action.description = 'actual';
END_ENTITY; -- realization_of_intended_activity_by_actual

ENTITY realization_of_intended_facility_or_material_by_actual
    SUBTYPE OF (product_definition_relationship);
    WHERE
        wr1: SELF.relating_product_definition.description = 'intended';
        wr2: SELF.related_product_definition.description = 'actual';
        wr3: SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name IN [
            'functional occurrence','physical occurrence'];
        wr4: SELF\product_definition_relationship.related_product_definition
            .frame_of_reference.name IN ['functional definition',
            'functional occurrence','physical definition',
            'functional occurrence','physical definition',
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        'physical occurrence'];
wr5: (NOT (SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name =
            'functional occurrence')) OR (SELF\
            product_definition_relationship.related_product_definition.
            frame_of_reference.name IN ['functional definition',
            'functional occurrence']);
wr6: (NOT (SELF\product_definition_relationship.
            relating_product_definition.frame_of_reference.name =
            'physical occurrence')) OR (SELF\
            product_definition_relationship.related_product_definition.
            frame_of_reference.name IN ['physical definition',
            'physical occurrence']);
END_ENTITY; -- realization_of_intended_facility_or_material_by_actual

ENTITY recognized_class_of_resource
  SUBTYPE OF (product_related_product_category);
  WHERE
    wr1: SELF.name = 'resource for facility';
    wr2: SIZEOF(QUERY ( pcr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') | ((pcr.name =
      'class assignment') AND (
      'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(pcr.
      sub_category)))) ) >= 1;
    wr3: SIZEOF(SELF.products) = 1;
    wr4: SIZEOF(QUERY ( pdf <* USEDIN(SELF.products[1],
      'PLANT_FUNCTIONAL_DATA.' +
      'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') | (NOT (SIZEOF(
      QUERY ( pd <* USEDIN(pdf,'PLANT_FUNCTIONAL_DATA.' +
      'PRODUCT_DEFINITION_FORMATION') | (NOT (pd\
      product_definition.frame_of_reference.name IN [
      'physical definition','physical occurrence'])) ) ) = 0)) ) ) = 0;
END_ENTITY; -- recognized_class_of_resource

ENTITY recognized_class_of_service
  SUBTYPE OF (product_related_product_category);
  WHERE
    wr1: SELF.name = 'service for material';
    wr2: SIZEOF(QUERY ( pcr <* USEDIN(SELF,'PLANT_FUNCTIONAL_DATA.' +
      'PRODUCT_CATEGORY_RELATIONSHIP.CATEGORY') | ((pcr.name =
      'class assignment') AND (
      'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(pcr.
      sub_category)))) ) >= 1;
    wr3: SIZEOF(SELF.products) = 1;
    wr4: SIZEOF(QUERY ( pdf <* USEDIN(SELF.products[1],
      'PLANT_FUNCTIONAL_DATA.' +

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'PRODUCT_DEFINITION_FORMATION.OF_PRODUCT') | (NOT (SIZEOF(
QUERY ( pd <* USEDIN(pdf,'PLANT_FUNCTIONAL_DATA.' +
'PRODUCT_DEFINITION_FORMATION') | (NOT (pd\
product_definition.frame_of_reference.name IN [
'functional definition','functional occurrence'])) )) = 0)) ))
= 0;
END_ENTITY; -- recognized_class_of_service

ENTITY recognized_provision_of_service_according_to_class
  SUPERTYPE OF (externally_defined_recognized_provision_of_service_according_to_class);
  SUBTYPE OF (product_category_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_FACILITY' IN TYPEOF(SELF \
      product_category_relationship.category);
    wr2: 'PLANT_FUNCTIONAL_DATA.CLASS_OF_MATERIAL' IN TYPEOF(SELF \
      product_category_relationship.sub_category);
END_ENTITY; -- recognized_provision_of_service_according_to_class

ENTITY reference_between_page_connector
  SUBTYPE OF (annotation_occurrence_relationship);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.PAGE_CONNECTOR' IN TYPEOF(SELF \
      relating_annotation_occurrence);
    wr2: 'PLANT_FUNCTIONAL_DATA.PAGE_CONNECTOR' IN TYPEOF(SELF \
      related_annotation_occurrence);
END_ENTITY; -- reference_between_page_connector

ENTITY representation;
  id : identifier;
  name : label;
  description : text;
  items : SET [1:?] OF representation_item;
  context_of_items : representation_context;
END_ENTITY; -- representation

ENTITY representation_alternative
  SUBTYPE OF (representation_relationship);
END_ENTITY; -- representation_alternative

ENTITY representation_context;
  context_identifier : identifier;
  context_type : text;
  INVERSE
    representations_in_context : SET [1:?] OF representation FOR
      context_of_items;
END_ENTITY; -- representation_context

ENTITY representation_derivation
  SUBTYPE OF (representation_relationship);
END_ENTITY; -- representation_derivation

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ENTITY representation_item;
    name : label;
WHERE
    wr1: SIZEOF(using_representations(SELF)) > 0;
END_ENTITY; -- representation_item

ENTITY representation_map;
    mapping_origin      : representation_item;
    mapped_representation : representation;
INVERSE
    map_usage : SET [1:?] OF mapped_item FOR mapping_source;
WHERE
    wr1: item_in_context(SELF.mapping_origin,SELF.mapped_representation.
        context_of_items);
END_ENTITY; -- representation_map

ENTITY representation_relationship;
    name      : label;
    description : text;
    rep_1     : representation;
    rep_2     : representation;
END_ENTITY; -- representation_relationship

ENTITY representation_relationship_with_transformation
SUBTYPE OF (representation_relationship);
    transformation_operator : transformation;
WHERE
    wr1: SELF\representation_relationship.rep_1.context_of_items :<>:
        SELF\representation_relationship.rep_2.context_of_items;
END_ENTITY; -- representation_relationship_with_transformation

ENTITY representation_version
SUBTYPE OF (representation_relationship);
END_ENTITY; -- representation_version

ENTITY serial_action_method
SUBTYPE OF (action_method_relationship);
END_ENTITY; -- serial_action_method

ENTITY shape_aspect;
    name      : label;
    description : text;
    of_shape   : product_definition_shape;
    product_definitional : LOGICAL;
END_ENTITY; -- shape_aspect

ENTITY shape_aspect_relationship;
    name      : label;
    description : text;

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    relating_shape_aspect : shape_aspect;
    related_shape_aspect : shape_aspect;
END_ENTITY; -- shape_aspect_relationship

ENTITY si_unit
    SUBTYPE OF (named_unit);
    prefix : OPTIONAL si_prefix;
    name   : si_unit_name;
DERIVE
    SELF\named_unit.dimensions : dimensional_exponents :=
                                dimensions_for_si_unit(SELF.name);
END_ENTITY; -- si_unit

ENTITY solid_angle_measure_with_unit
    SUBTYPE OF (measure_with_unit);
WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.SOLID_ANGLE_UNIT' IN TYPEOF(SELF\
               measure_with_unit.unit_component);
END_ENTITY; -- solid_angle_measure_with_unit

ENTITY solid_angle_unit
    SUBTYPE OF (named_unit);
WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
               named_unit.dimensions.mass_exponent = 0) AND (SELF\
               named_unit.dimensions.time_exponent = 0) AND (SELF\
               named_unit.dimensions.electric_current_exponent = 0) AND (
               SELF\named_unit.dimensions.
               thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
               .dimensions.amount_of_substance_exponent = 0) AND (SELF\
               named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- solid_angle_unit

ENTITY specified_higher_usage_occurrence
    SUBTYPE OF (assembly_component_usage);
    upper_usage : assembly_component_usage;
    next_usage  : next_assembly_usage_occurrence;
UNIQUE
    url : upper_usage, next_usage;
WHERE
    wr1: SELF :<>: upper_usage;
    wr2: SELF\product_definition_relationship.
        relating_product_definition ::= upper_usage.
        relating_product_definition;
    wr3: SELF\product_definition_relationship.related_product_definition
        ::= next_usage.related_product_definition;
    wr4: upper_usage.related_product_definition ::= next_usage.
        relating_product_definition;

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wr5: NOT (( 'PLANT_FUNCTIONAL_DATA.' + 'PROMISSORY_USAGE_OCCURRENCE' )
           IN TYPEOF(upper_usage));
END_ENTITY; -- specified_higher_usage_occurrence

ENTITY standard_class_of_activity
  SUBTYPE OF (class_of_activity, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_activity

ENTITY standard_class_of_annotation_element
  SUBTYPE OF (class_of_annotation_element, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_annotation_element

ENTITY standard_class_of_facility
  SUBTYPE OF (class_of_facility, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_facility

ENTITY standard_class_of_information_content
  SUBTYPE OF (class_of_information_content, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_information_content

ENTITY standard_class_of_involvement
  SUBTYPE OF (class_of_involvement, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_involvement

ENTITY standard_class_of_material
  SUBTYPE OF (class_of_material, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_material

ENTITY standard_class_of_property
  SUBTYPE OF (class_of_property, pre_defined_item);
  WHERE
    wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_class_of_property

ENTITY standard_classification_of_class_of_annotation_element
  SUBTYPE OF (classification_of_class_of_annotation_element,
              pre_defined_item);

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WHERE
wr1: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_classification_of_class_of_annotation_element

ENTITY standard_classification_of_class_of_facility
SUBTYPE OF (classification_of_class_of_facility, pre_defined_item);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_FACILITY' IN TYPEOF(
    SELF\group_relationship.relating_group);
wr2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_FACILITY' IN TYPEOF(
    SELF\group_relationship.related_group);
wr3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_classification_of_class_of_facility

ENTITY standard_classification_of_class_of_material
SUBTYPE OF (classification_of_class_of_material, pre_defined_item);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_MATERIAL' IN TYPEOF(
    SELF\group_relationship.relating_group);
wr2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_MATERIAL' IN TYPEOF(
    SELF\group_relationship.related_group);
wr3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_classification_of_class_of_material

ENTITY standard_involvement_in_activity_class_constraint
SUBTYPE OF (involvement_in_activity_class_constraint, pre_defined_item);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ACTIVITY' IN TYPEOF(
    SELF\group_relationship.relating_group);
wr2: 'PLANT_FUNCTIONAL_DATA.STANDARD_CLASS_OF_ININVOLVEMENT' IN
    TYPEOF(SELF\group_relationship.related_group);
wr3: SELF\pre_defined_item.name = 'ISO 10303-221 standard data';
END_ENTITY; -- standard_involvement_in_activity_class_constraint

ENTITY styled_item
SUBTYPE OF (representation_item);
styles : SET [1:?] OF presentation_style_assignment;
item   : representation_item;
WHERE
wr1: (SIZEOF(SELF.styles) = 1) XOR (SIZEOF(QUERY ( pres_style <*
    SELF.styles | (NOT (( 'PLANT_FUNCTIONAL_DATA.' +
    'PRESENTATION_STYLE_BY_CONTEXT') IN TYPEOF(pres_style)))) ) )
= 0;
END_ENTITY; -- styled_item

ENTITY symbol_colour;
colour_of_symbol : colour;
END_ENTITY; -- symbol_colour
```

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ENTITY symbol_representation
  SUBTYPE OF (representation);
END_ENTITY; -- symbol_representation

ENTITY symbol_representation_map
  SUBTYPE OF (representation_map);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.SYMBOL_REPRESENTATION' IN TYPEOF(SELF \
      representation_map.mapped_representation);
    wr2: 'PLANT_FUNCTIONAL_DATA.AXIS2_PLACEMENT' IN TYPEOF(SELF \
      representation_map.mapping_origin);
END_ENTITY; -- symbol_representation_map

ENTITY symbol_style;
  name          : label;
  style_of_symbol : symbol_style_select;
END_ENTITY; -- symbol_style

ENTITY symbol_target
  SUBTYPE OF (geometric_representation_item);
  placement : axis2_placement;
  x_scale   : positive_ratio_measure;
  y_scale   : positive_ratio_measure;
END_ENTITY; -- symbol_target

ENTITY terminator_symbol
  SUBTYPE OF (annotation_symbol_occurrence);
  annotated_curve : annotation_curve_occurrence;
END_ENTITY; -- terminator_symbol

ENTITY text_literal
  SUBTYPE OF (geometric_representation_item);
  literal      : presentable_text;
  placement    : axis2_placement;
  alignment    : text_alignment;
  path         : text_path;
  font         : font_select;
END_ENTITY; -- text_literal

ENTITY text_literal_with_associated_curves
  SUBTYPE OF (text_literal);
  associated_curves : SET [1:?] OF curve;
END_ENTITY; -- text_literal_with_associated_curves

ENTITY text_literal_with_blanking_box
  SUBTYPE OF (text_literal);
  blanking     : planar_box;
END_ENTITY; -- text_literal_with_blanking_box

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ENTITY text_literal_with_delineation
  SUBTYPE OF (text_literal);
    delineation : text_delineation;
END_ENTITY; -- text_literal_with_delineation

ENTITY text_literal_with_extent
  SUBTYPE OF (text_literal);
    extent : planar_extent;
END_ENTITY; -- text_literal_with_extent

ENTITY text_style;
  name : label;
  character_appearance : character_style_select;
END_ENTITY; -- text_style

ENTITY text_style_for_defined_font;
  text_colour : colour;
END_ENTITY; -- text_style_for_defined_font

ENTITY text_style_with_box_characteristics
  SUBTYPE OF (text_style);
  characteristics : SET [1:4] OF box_characteristic_select;
  WHERE
    wr1: SIZEOF(QUERY ( c1 <* SELF.characteristics | (SIZEOF(
      QUERY ( c2 <* (SELF.characteristics - c1) | (TYPEOF(c1) =
      TYPEOF(c2)) )) > 0) )) = 0;
END_ENTITY; -- text_style_with_box_characteristics

ENTITY text_style_with_mirror
  SUBTYPE OF (text_style);
  mirror_placement : axis2_placement;
END_ENTITY; -- text_style_with_mirror

ENTITY thermodynamic_temperature_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.THERMODYNAMIC_TEMPERATURE_UNIT' IN
      TYPEOF(SELF\measure_with_unit.unit_component);
END_ENTITY; -- thermodynamic_temperature_measure_with_unit

ENTITY thermodynamic_temperature_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
      named_unit.dimensions.mass_exponent = 0) AND (SELF\
      named_unit.dimensions.time_exponent = 0) AND (SELF\
      named_unit.dimensions.electric_current_exponent = 0) AND (
      SELF\named_unit.dimensions.
      thermodynamic_temperature_exponent = 1) AND (SELF\named_unit

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.dimensions.amount_of_substance_exponent = 0) AND (SELF\
named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- thermodynamic_temperature_unit

ENTITY time_measure_with_unit
  SUBTYPE OF (measure_with_unit);
  WHERE
    wr1: 'PLANT_FUNCTIONAL_DATA.TIME_UNIT' IN TYPEOF(SELF\
measure_with_unit.unit_component);
END_ENTITY; -- time_measure_with_unit

ENTITY time_unit
  SUBTYPE OF (named_unit);
  WHERE
    wr1: (SELF\named_unit.dimensions.length_exponent = 0) AND (SELF\
named_unit.dimensions.mass_exponent = 0) AND (SELF\
named_unit.dimensions.time_exponent = 1) AND (SELF\
named_unit.dimensions.electric_current_exponent = 0) AND ((
SELF\named_unit.dimensions.
thermodynamic_temperature_exponent = 0) AND (SELF\named_unit
.dimensions.amount_of_substance_exponent = 0) AND (SELF\
named_unit.dimensions.luminous_intensity_exponent = 0));
END_ENTITY; -- time_unit

ENTITY topological_sequence_of_facility
  SUBTYPE OF (product_definition, product_definition_relationship);
  WHERE
    wr1: SELF\product_definition_relationship.
      relating_product_definition.frame_of_reference.name IN [
        'functional definition', 'functional occurrence'];
    wr2: SELF\product_definition_relationship.related_product_definition
      .frame_of_reference.name IN ['functional definition',
      'functional occurrence'];
    wr3: SIZEOF(QUERY ( pdr <* USEDIN(SELF,
      'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION_RELATIONSHIP.' +
      'RELATED_PRODUCT_DEFINITION') | ((pdr.name =
      'context for sequence') AND (pdr.relating_product_definition
      .frame_of_reference.name IN ['functional definition',
      'functional occurrence'])) )) ) >= 1;
END_ENTITY; -- topological_sequence_of_facility

ENTITY trimmed_curve
  SUBTYPE OF (bounded_curve);
  basis_curve : curve;
  trim_1       : SET [1:2] OF trimming_select;
  trim_2       : SET [1:2] OF trimming_select;
  sense_agreement : BOOLEAN;
  master_representation : trimming_preference;

```

```

WHERE
wr1: (HIINDEX(trim_1) = 1) XOR (TYPEOF(trim_1[1]) <> TYPEOF(trim_1[2]));
wr2: (HIINDEX(trim_2) = 1) XOR (TYPEOF(trim_2[1]) <> TYPEOF(trim_2[2]));
END_ENTITY; -- trimmed_curve

ENTITY two_direction_repeat_factor
SUBTYPE OF (one_direction_repeat_factor);
second_repeat_factor : vector;
END_ENTITY; -- two_direction_repeat_factor

ENTITY type_qualifier;
name : label;
END_ENTITY; -- type_qualifier

ENTITY uniform_curve
SUBTYPE OF (b_spline_curve);
END_ENTITY; -- uniform_curve

ENTITY usage_of_facility_in_connection
SUBTYPE OF (product_definition_relationship,product_definition);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY' IN TYPEOF(SELF.
relating_product_definition);
wr2: SELF.related_product_definition.frame_of_reference.name IN [
'functional definition','functional occurrence'];
END_ENTITY; -- usage_of_facility_in_connection

ENTITY usage_of_feature_in_connection
SUBTYPE OF (shape_aspect_relationship, shape_aspect);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_SHAPE_ASPECT' IN TYPEOF(SELF \
shape_aspect_relationship.relating_shape_aspect);
END_ENTITY; -- usage_of_feature_in_connection

ENTITY usage_of_material_in_connection
SUBTYPE OF (product_definition_relationship,product_definition);
WHERE
wr1: 'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL' IN TYPEOF(SELF .
relating_product_definition);
wr2: SELF.related_product_definition.frame_of_reference.name IN [
'physical definition','physical occurrence'];
END_ENTITY; -- usage_of_material_in_connection

ENTITY vector
SUBTYPE OF (geometric_representation_item);
orientation : direction;
magnitude : length_measure;
WHERE
wr1: magnitude >= 0;
END_ENTITY; -- vector

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ENTITY view_dependent_invisibility
SUBTYPE OF (context_dependent_invisibility);
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.PRESENTATION_VIEW' IN TYPEOF(SELF.
    presentation_context);
  wr2: SIZEOF(QUERY ( item <* SELF\invisibility.invisible_items | (
    NOT (SIZEOF(TYPEOF(item) * [
      'PLANT_FUNCTIONAL_DATA.ANNOTATION_OCCURRENCE',
      'PLANT_FUNCTIONAL_DATA.PRESENTATION_LAYER_ASSIGNMENT']) = 1))) ) =
  0;
END_ENTITY; -- view_dependent_invisibility

ENTITY volume_measure_with_unit
SUBTYPE OF (measure_with_unit);
WHERE
  wr1: 'PLANT_FUNCTIONAL_DATA.VOLUME_UNIT' IN TYPEOF(SELF\
    measure_with_unit.unit_component);
END_ENTITY; -- volume_measure_with_unit

ENTITY volume_unit
SUBTYPE OF (named_unit);
WHERE
  wr1: (SELF\named_unit.dimensions.length_exponent = 3) AND (SELF\
    named_unit.dimensions.mass_exponent = 0) AND (SELF\
    named_unit.dimensions.time_exponent = 0) AND (SELF\
    named_unit.dimensions.electric_current_exponent = 0) AND (
    SELF\named_unit.dimensions.
    thermodynamic_temperature_exponent = 0) AND (SELF\named_unit.
    dimensions.amount_of_substance_exponent = 0) AND (SELF\
    named_unit.dimensions.luminous_intensity_exponent = 0);
END_ENTITY; -- volume_unit

RULE activity_life_cycle FOR (action, action_method);
WHERE
  wr1: SIZEOF(QUERY ( act <* action | (NOT (act.description IN [
    'intended','actual'])) )) = 0;
  wr2: SIZEOF(QUERY ( acm <* action_method | (NOT (acm.description =
    'actual')) )) = 0;
END_RULE; -- activity_life_cycle

RULE actual_or_intended_effectivity FOR (effectivity);
WHERE
  wr1: SIZEOF(QUERY ( e <* effectivity | (NOT (e.description IN [
    'actual','intended'])) )) = 0;
END_RULE; -- actual_or_intended_effectivity

RULE approval_status_constraint FOR (approval_status);
WHERE

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wrl1: SIZEOF(QUERY ( stat <* approval_status | (NOT (stat.name IN [
    'passed', 'rejected'])) )) = 0;
END_RULE; -- approval_status_constraint

RULE compatible_dimension FOR (cartesian_point, direction,
    representation_context, geometric_representation_context);
WHERE
    wrl1: SIZEOF(QUERY ( x <* cartesian_point | (SIZEOF(QUERY ( y <*
        geometric_representation_context | (item_in_context(x,y) AND (
            HIINDEX(x.coordinates) <> y.coordinate_space_dimension))) ) >
        0) )) = 0;
    wr2: SIZEOF(QUERY ( x <* direction | (SIZEOF(QUERY ( y <*
        geometric_representation_context | (item_in_context(x,y) AND (
            HIINDEX(x.direction_ratios) <> y.coordinate_space_dimension))) ) >
        0) )) = 0;
END_RULE; -- compatible_dimension

RULE drawing_sheets_not_nested FOR (
    presentation_representation_relationship);
WHERE
    wrl1: SIZEOF(QUERY ( p_r_r <* presentation_representation_relationship
        | (('PLANT_FUNCTIONAL_DATA.DRAWING_SHEET_REVISION' IN TYPEOF(
            p_r_r.rep_1)) AND (
            'PLANT_FUNCTIONAL_DATA.DRAWING_SHEET_REVISION' IN TYPEOF(p_r_r
                .rep_2)))) ) = 0;
END_RULE; -- drawing_sheets_not_nested

RULE external_source_product_definition_correlation FOR (
    external_source_product_definition_alias, product_definition);
WHERE
    wrl1: SIZEOF(QUERY ( espda <* external_source_product_definition_alias
        | (NOT (SIZEOF(QUERY ( pd <* product_definition | ((pd.id =
            espda.source_id) AND (pd.frame_of_reference.name IN [
                'functional definition', 'functional occurrence',
                'physical definition', 'physical occurrence'])) ) = 1))) ) = 0;
END_RULE; -- external_source_product_definition_correlation

RULE facility_and_material_life_cycle FOR (product_definition);
WHERE
    wrl1: SIZEOF(QUERY ( fac_mat <* QUERY ( pd <* product_definition | (pd\
        product_definition.frame_of_reference.name IN [
            'functional definition', 'functional occurrence',
            'physical definition', 'physical occurrence']) ) | (NOT (
                fac_mat\product_definition.description IN ['intended', 'actual'])) ) =
        0;
    wr2: SIZEOF(QUERY ( fac_mat <* QUERY ( pd <* product_definition | (pd\
        product_definition.frame_of_reference.name IN [
            'functional definition', 'physical definition']) ) | (NOT (

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        fac_mat\product_definition.description = 'actual')) )) = 0;
END_RULE; -- facility_and_material_life_cycle

RULE plant_functional_layered_items FOR (presentation_layer_assignment);
WHERE
    wr1: SIZEOF(QUERY ( pla <* presentation_layer_assignment | (NOT (
        SIZEOF(QUERY ( item <* pla.assigned_items | (
            'PLANT_FUNCTIONAL_DATA.PRESENTATION_REPRESENTATION' IN TYPEOF(
            item)) )) = 0)) )) = 0;
END_RULE; -- plant_functional_layered_items

RULE product_definition_relationship_life_cycle FOR (
    product_definition_relationship);
WHERE
    wr1: SIZEOF(QUERY ( pf_pdr <* QUERY ( pdr <*
        product_definition_relationship | (SIZEOF(TYPEOF(pdr) * [
            'PLANT_FUNCTIONAL_DATA.PROVISION_OF_SERVICE',
            'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_FACILITY',
            'PLANT_FUNCTIONAL_DATA.CONNECTION_OF_MATERIAL',
            'PLANT_FUNCTIONAL_DATA.USAGE_OF_MATERIAL_IN_CONNECTION',
            'PLANT_FUNCTIONAL_DATA.COLLECTION_OF_FACILITY',
            'PLANT_FUNCTIONAL_DATA.COLLECTION_OF_MATERIAL',
            'ASSEMBLY_OF_FACILITY', 'ASSEMBLY_OF_MATERIAL']) <> 0) ) | (
        NOT (pf_pdr.description IN ['intended', 'actual'])) )) = 0;
END_RULE; -- product_definition_relationship_life_cycle

RULE symbol_representation_rule FOR (
    presentation_representation_relationship);
WHERE
    wr1: SIZEOF(QUERY ( each_1 <* presentation_representation_relationship
        | ((NOT (('PLANT_FUNCTIONAL_DATA.' +
            'SYMBOL REPRESENTATION_RELATIONSHIP') IN TYPEOF(each_1))) AND
            (SIZEOF(QUERY ( each_2 <* [each_1\representation_relationship.
                rep_1,each_1\representation_relationship.rep_2] | (
                    'PLANT_FUNCTIONAL_DATA.SYMBOL REPRESENTATION' IN TYPEOF(each_2)) )) > 0)) )) = 0;
END_RULE; -- symbol_representation_rule

FUNCTION acyclic_composite_text(
    start_composite: composite_text;
    child_text: SET [1:?] OF text_or_character
): LOGICAL;
LOCAL
    i : INTEGER;
    local_annotation_text : SET [0:?] OF annotation_text;
    local_composite_text : SET [0:?] OF composite_text;
    local_children : SET [0:?] OF text_or_character;
END_LOCAL;

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local_composite_text := QUERY ( child <* child_text | (
    'PLANT_FUNCTIONAL_DATA.COMPOSITE_TEXT' IN TYPEOF(child)) );
IF SIZEOF(local_composite_text) > 0 THEN
    REPEAT i := 1 TO HIINDEX(local_composite_text) BY 1;
        IF start_composite == local_composite_text[i] THEN
            RETURN(FALSE);
        END_IF;
    END_REPEAT;
END_IF;
local_children := child_text;
IF SIZEOF(local_composite_text) > 0 THEN
    REPEAT i := 1 TO HIINDEX(local_composite_text) BY 1;
        local_children := local_children + local_composite_text[i].
            collected_text;
    END_REPEAT;
END_IF;
local_annotation_text := QUERY ( child <* child_text | (
    'PLANT_FUNCTIONAL_DATA.ANNOTATION_TEXT' IN TYPEOF(child)) );
IF SIZEOF(local_annotation_text) > 0 THEN
    REPEAT i := 1 TO HIINDEX(local_annotation_text) BY 1;
        local_children := local_children + QUERY ( item <*
            local_annotation_text[i]\mapped_item.mapping_source.
            mapped_representation.items | (SIZEOF([
                'PLANT_FUNCTIONAL_DATA.ANNOTATION_TEXT',
                'PLANT_FUNCTIONAL_DATA.COMPOSITE_TEXT']) * TYPEOF(item)) > 0 ) );
    END_REPEAT;
END_IF;
IF local_children <> child_text THEN
    RETURN(acyclic_composite_text(start_composite,local_children));
ELSE
    RETURN(TRUE);
END_IF;
END_FUNCTION; -- acyclic_composite_text

FUNCTION acyclic_mapped_representation(
    parent_set: SET OF representation;
    children_set: SET OF representation_item
): BOOLEAN;
LOCAL
    i : INTEGER;
    x : SET OF representation_item;
    y : SET OF representation_item;
END_LOCAL;
x := QUERY ( z <* children_set | ('PLANT_FUNCTIONAL_DATA.MAPPED_ITEM'
    IN TYPEOF(z)) );
IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
```

```

IF x[i]\mapped_item.mapping_source.mapped_representation IN
    parent_set THEN
    RETURN(FALSE);
END_IF;
IF NOT acyclic_mapped_representation(parent_set + x[i]\mapped_item.
    .mapping_source.mapped_representation,x[i]\mapped_item.
    mapping_source.mapped_representation.items) THEN
    RETURN(FALSE);
END_IF;
END_REPEAT;
END_IF;
x := children_set - x;
IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
        y := QUERY ( z <* bag_to_set(USEDIN(x[i],'')) | (
            'PLANT_FUNCTIONAL_DATA.REPRESENTATION_ITEM' IN TYPEOF(z)) );
        IF NOT acyclic_mapped_representation(parent_set,y) THEN
            RETURN(FALSE);
        END_IF;
    END_REPEAT;
END_IF;
RETURN(TRUE);
END_FUNCTION; -- acyclic_mapped_representation

FUNCTION acyclic_presentation_representation_relationship(
    relation: presentation_representation_relationship;
    children: SET OF presentation_representation
): BOOLEAN;
LOCAL
    i : INTEGER;
    x : SET OF presentation_representation_relationship;
    local_children : SET OF presentation_representation;
END_LOCAL;
REPEAT i := 1 TO HIINDEX(children) BY 1;
    IF relation\representation_relationship.rep_1 ==: children[i] THEN
        RETURN(FALSE);
    END_IF;
END_REPEAT;
x := USEDIN(relation\representation_relationship.rep_1,
    'PLANT_FUNCTIONAL_DATA.' + 'PRESENTATION_RELATIONSHIP.REP_2');
local_children := children + relation\representation_relationship.
    rep_1;
IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
        IF NOT acyclic_presentation_representation_relationship(x[i],
            local_children) THEN
            RETURN(FALSE);
    END_REPEAT;
END_IF;

```

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        END_IF;
    END_REPEAT;
END_IF;
RETURN(TRUE);
END_FUNCTION; -- acyclic_presentation_representation_relationship

FUNCTION acyclic_product_category_relationship(
    relation: product_category_relationship;
    children: SET OF product_category
): LOGICAL;
LOCAL
    i : INTEGER;
    x : SET OF product_category_relationship;
    local_children : SET OF product_category;
END_LOCAL;
REPEAT i := 1 TO HIINDEX(children) BY 1;
    IF relation.category ==: children[i] THEN
        RETURN(FALSE);
    END_IF;
END_REPEAT;
x := bag_to_set(USEDIN(relation.category, 'PLANT_FUNCTIONAL_DATA.' +
    'PRODUCT_CATEGORY_RELATIONSHIP.SUB_CATEGORY'));
local_children := children + relation.category;
IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
        IF NOT acyclic_product_category_relationship(x[i], local_children)
            THEN
                RETURN(FALSE);
            END_IF;
    END_REPEAT;
END_IF;
RETURN(TRUE);
END_FUNCTION; -- acyclic_product_category_relationship

FUNCTION acyclic_product_definition_relationship(
    relation: product_definition_relationship;
    relatives: SET OF product_definition;
    specific_relation: STRING
): LOGICAL;
LOCAL
    i : INTEGER;
    x : SET OF product_definition_relationship;
    local_relatives : SET OF product_definition;
END_LOCAL;
REPEAT i := 1 TO HIINDEX(relatives) BY 1;
    IF relation.relatives_product_definition ==: relatives[i] THEN
        RETURN(FALSE);

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        END_IF;
END_REPEAT;
x := bag_to_set(USEDIN(relation.relating_product_definition,
    specific_relation));
local_relatives := relatives + relation.relating_product_definition;
IF SIZEOF(x) > 0 THEN
    REPEAT i := 1 TO HIINDEX(x) BY 1;
        IF NOT acyclic_product_definition_relationship(x[i],
            local_relatives,specific_relation) THEN
            RETURN(FALSE);
        END_IF;
    END_REPEAT;
END_IF;
RETURN(TRUE);
END_FUNCTION; -- acyclic_product_definition_relationship

FUNCTION bag_to_set(
    the_bag: BAG OF GENERIC:intype
): SET OF GENERIC:intype;
LOCAL
    i : INTEGER;
    the_set : SET OF GENERIC:intype := [];
END_LOCAL;
IF SIZEOF(the_bag) > 0 THEN
    REPEAT i := 1 TO HIINDEX(the_bag) BY 1;
        the_set := the_set + the_bag[i];
    END_REPEAT;
END_IF;
RETURN(the_set);
END_FUNCTION; -- bag_to_set

FUNCTION build_2axes(
    ref_direction: direction
): LIST [2:2] OF direction;
LOCAL
    u : LIST [2:2] OF direction;
END_LOCAL;
u[1] := NVL(normalise(ref_direction),direction([1,0]));
u[2] := orthogonal_complement(u[1]);
RETURN(u);
END_FUNCTION; -- build_2axes

FUNCTION constraints_param_b_spline(
    degree, up_knots, up_cp: INTEGER;
    knot_mult: LIST OF INTEGER;
    knots: LIST OF parameter_value
): BOOLEAN;
LOCAL

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k      : INTEGER;
l      : INTEGER;
sum   : INTEGER;
result : BOOLEAN := TRUE;
END_LOCAL;
sum := knot_mult[1];
REPEAT i := 2 TO up_knots BY 1;
  sum := sum + knot_mult[i];
END_REPEAT;
IF (degree < 1) OR (up_knots < 2) OR (up_cp < degree) OR (sum <> (
  degree + up_cp + 2)) THEN
  result := FALSE;
  RETURN(result);
END_IF;
k := knot_mult[1];
IF (k < 1) OR (k > (degree + 1)) THEN
  result := FALSE;
  RETURN(result);
END_IF;
REPEAT i := 2 TO up_knots BY 1;
  IF (knot_mult[i] < 1) OR (knots[i] <= knots[i - 1]) THEN
    result := FALSE;
    RETURN(result);
  END_IF;
  k := knot_mult[i];
  IF (i < up_knots) AND (k > degree) THEN
    result := FALSE;
    RETURN(result);
  END_IF;
  IF (i = up_knots) AND (k > (degree + 1)) THEN
    result := FALSE;
    RETURN(result);
  END_IF;
END_REPEAT;
RETURN(result);
END_FUNCTION; -- constraints_param_b_spline

FUNCTION curve_weights_positive(
  b: rational_b_spline_curve
): BOOLEAN;
LOCAL
  result : BOOLEAN := TRUE;
END_LOCAL;
REPEAT i := 0 TO b.upper_index_on_control_points BY 1;
  IF b.weights[i] <= 0 THEN
    result := FALSE;
    RETURN(result);

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        END_IF;
    END_REPEAT;
    RETURN(result);
END_FUNCTION; -- curve_weights_positive

FUNCTION derive_dimensional_exponents(
    x: unit
) : dimensional_exponents;
LOCAL
    i      : INTEGER;
    result : dimensional_exponents := dimensional_exponents(0,0,0,0,0,0,
        0);
END_LOCAL;
IF 'PLANT_FUNCTIONAL_DATA.DERIVED_UNIT' IN TYPEOF(x) THEN
    REPEAT i := LOINDEX(x.elements) TO HIINDEX(x.elements) BY 1;
        result.length_exponent := result.length_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.length_exponent);
        result.mass_exponent := result.mass_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.mass_exponent);
        result.time_exponent := result.time_exponent + (x.elements[i].
            exponent * x.elements[i].unit.dimensions.time_exponent);
        result.electric_current_exponent := result.
            electric_current_exponent + (x.elements[i].exponent * x.
            elements[i].unit.dimensions.electric_current_exponent);
        result.thermodynamic_temperature_exponent := result.
            thermodynamic_temperature_exponent + (x.elements[i].exponent * x.
            elements[i].unit.dimensions.
            thermodynamic_temperature_exponent);
        result.amount_of_substance_exponent := result.
            amount_of_substance_exponent + (x.elements[i].exponent * x.
            elements[i].unit.dimensions.amount_of_substance_exponent);
        result.luminous_intensity_exponent := result.
            luminous_intensity_exponent + (x.elements[i].exponent * x.
            elements[i].unit.dimensions.luminous_intensity_exponent);
    END_REPEAT;
ELSE
    result := x.dimensions;
END_IF;
RETURN(result);
END_FUNCTION; -- derive_dimensional_exponents

FUNCTION dimension_of(
    item: geometric_representation_item
) : dimension_count;
LOCAL
    x : SET OF representation;
    y : representation_context;

```

```

END_LOCAL;
x := using_representations(item);
y := x[1].context_of_items;
RETURN(y\geometric_representation_context.coordinate_space_dimension);
END_FUNCTION; -- dimension_of

FUNCTION dimensions_for_si_unit(
    n: si_unit_name
    ): dimensional_exponents;
CASE n OF
    metre      : RETURN(dimensional_exponents(1,0,0,0,0,0,0));
    gram       : RETURN(dimensional_exponents(0,1,0,0,0,0,0));
    second     : RETURN(dimensional_exponents(0,0,1,0,0,0,0));
    ampere     : RETURN(dimensional_exponents(0,0,0,1,0,0,0));
    kelvin     : RETURN(dimensional_exponents(0,0,0,0,1,0,0));
    mole       : RETURN(dimensional_exponents(0,0,0,0,0,1,0));
    candela    : RETURN(dimensional_exponents(0,0,0,0,0,0,1));
    radian     : RETURN(dimensional_exponents(0,0,0,0,0,0,0));
    steradian   : RETURN(dimensional_exponents(0,0,0,0,0,0,0));
    hertz      : RETURN(dimensional_exponents(0,0,-1,0,0,0,0));
    newton     : RETURN(dimensional_exponents(1,1,-2,0,0,0,0));
    pascal     : RETURN(dimensional_exponents(-1,1,-2,0,0,0,0));
    joule      : RETURN(dimensional_exponents(2,1,-2,0,0,0,0));
    watt       : RETURN(dimensional_exponents(2,1,-3,0,0,0,0));
    coulomb    : RETURN(dimensional_exponents(0,0,1,1,0,0,0));
    volt       : RETURN(dimensional_exponents(2,1,-3,-1,0,0,0));
    farad      : RETURN(dimensional_exponents(-2,-1,4,1,0,0,0));
    ohm        : RETURN(dimensional_exponents(2,1,-3,-2,0,0,0));
    siemens    : RETURN(dimensional_exponents(-2,-1,3,2,0,0,0));
    weber      : RETURN(dimensional_exponents(2,1,-2,-1,0,0,0));
    tesla      : RETURN(dimensional_exponents(0,1,-2,-1,0,0,0));
    henry      : RETURN(dimensional_exponents(2,1,-2,-2,0,0,0));
    degree_celsius : RETURN(dimensional_exponents(0,0,0,0,1,0,0));
    lumen      : RETURN(dimensional_exponents(0,0,0,0,0,0,1));
    lux        : RETURN(dimensional_exponents(-2,0,0,0,0,0,1));
    becquerel  : RETURN(dimensional_exponents(0,0,-1,0,0,0,0));
    gray       : RETURN(dimensional_exponents(2,0,-2,0,0,0,0));
    sievert    : RETURN(dimensional_exponents(2,0,-2,0,0,0,0));
END_CASE;
END_FUNCTION; -- dimensions_for_si_unit

FUNCTION item_in_context(
    item: representation_item;
    ctxt: representation_context
    ): BOOLEAN;
LOCAL
    i : INTEGER;

```

```

y : BAG OF representation_item;
END_LOCAL;
IF SIZEOF(USEDIN(item,'PLANT_FUNCTIONAL_DATA.REPRESENTATION.ITEMS') * 
    ctxt.representations_in_context) > 0 THEN
    RETURN(TRUE);
ELSE
    y := QUERY ( z <* USEDIN(item,'') | (
        'PLANT_FUNCTIONAL_DATA.REPRESENTATION_ITEM' IN TYPEOF(z)) );
    IF SIZEOF(y) > 0 THEN
        REPEAT i := 1 TO HIINDEX(y) BY 1;
            IF item_in_context(y[i],ctxt) THEN
                RETURN(TRUE);
            END_IF;
        END_REPEAT;
    END_IF;
END_IF;
RETURN(FALSE);
END_FUNCTION; -- item_in_context

FUNCTION list_to_array(
    lis: LIST [0:?] OF GENERIC:t;
    low, u: INTEGER
): ARRAY [low:u] OF GENERIC:t;
LOCAL
    n : INTEGER;
    res : ARRAY [low:u] OF GENERIC:t;
END_LOCAL;
n := SIZEOF(lis);
IF n <> ((u - low) + 1) THEN
    RETURN(?);
ELSE
    REPEAT i := 1 TO n BY 1;
        res[(low + i) - 1] := lis[i];
    END_REPEAT;
    RETURN(res);
END_IF;
END_FUNCTION; -- list_to_array

FUNCTION normalise(
    arg: vector_or_direction
): vector_or_direction;
LOCAL
    ndim : INTEGER;
    v : direction;
    vec : vector;
    mag : REAL;
    result : vector_or_direction;

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END_LOCAL;
IF NOT EXISTS(arg) THEN
    result := ?;
ELSE
    ndim := arg.dim;
    IF 'PLANT_FUNCTIONAL_DATA.VECTOR' IN TYPEOF(arg) THEN
        BEGIN
            vec := arg;
            v := arg.orientation;
            IF arg.magnitude = 0 THEN
                RETURN(?);
            ELSE
                vec.magnitude := 1;
            END_IF;
        END;
    ELSE
        v := arg;
    END_IF;
    mag := 0;
    REPEAT i := 1 TO ndim BY 1;
        mag := mag + (v.direction_ratios[i] * v.direction_ratios[i]);
    END_REPEAT;
    IF mag > 0 THEN
        mag := SQRT(mag);
        REPEAT i := 1 TO ndim BY 1;
            v.direction_ratios[i] := v.direction_ratios[i] / mag;
        END_REPEAT;
        IF 'PLANT_FUNCTIONAL_DATA.VECTOR' IN TYPEOF(arg) THEN
            vec.orientation := v;
            result := vec;
        ELSE
            result := v;
        END_IF;
    ELSE
        RETURN(?);
    END_IF;
    RETURN(result);
END_FUNCTION; -- normalise

FUNCTION orthogonal_complement(
    vec: direction
    ): direction;
LOCAL
    result : direction;
END_LOCAL;
IF (vec.dim <> 2) OR (NOT EXISTS(vec)) THEN
```

```

        RETURN(?) ;
ELSE
    result.direction_ratios[1] := -vec.direction_ratios[2];
    result.direction_ratios[2] := vec.direction_ratios[1];
    RETURN(result);
END_IF;
END_FUNCTION; -- orthogonal_complement

FUNCTION plant_functional_organization_correlation(
    e: plant_functional_organization_assignment
): BOOLEAN;
LOCAL
    o_role : STRING;
END_LOCAL;
o_role := e\organization_assignment.role.name;
CASE o_role OF
    'identification scheme maintainer' : IF SIZEOF(e.items) <> SIZEOF(QUERY ( x <* e.items | (SIZEOF([
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION',
        'PLANT_FUNCTIONAL_DATA.PRODUCT_CATEGORY',
        'PLANT_FUNCTIONAL_DATA.' + 'PRODUCT_DEFINITION_RELATIONSHIP'] * TYPEOF(x)) = 1) )) THEN
        RETURN(FALSE);
    END_IF;
    'identification scheme user' : IF SIZEOF(e.items) <> SIZEOF(QUERY ( x <* e.items | (SIZEOF([
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION',
        'PLANT_FUNCTIONAL_DATA.PRODUCT_CATEGORY',
        'PLANT_FUNCTIONAL_DATA.' + 'PRODUCT_DEFINITION_RELATIONSHIP'] * TYPEOF(x)) = 1) )) THEN
        RETURN(FALSE);
    END_IF;
    'designer' : IF SIZEOF(e.items) <> SIZEOF(
        QUERY ( x <* e.items | ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE'
        IN TYPEOF(x)) )) THEN
        RETURN(FALSE);
    END_IF;
    'checker' : IF SIZEOF(e.items) <> SIZEOF(
        QUERY ( x <* e.items | ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE'
        IN TYPEOF(x)) )) THEN
        RETURN(FALSE);
    END_IF;
    'controller' : IF SIZEOF(e.items) <> SIZEOF(
        QUERY ( x <* e.items | (('PLANT_FUNCTIONAL_DATA.' +
        'INFORMATION_CONTENT REPRESENTATION') IN TYPEOF(x)) )) THEN
        RETURN(FALSE);
    END_IF;

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'owner' : IF SIZEOF(e.items) <> (SIZEOF(
    QUERY ( x <* QUERY ( y <* e.items | (
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(y)) ) | (x
        \product_definition.frame_of_reference.name IN [
            'physical definition','physical occurrence']) ) + SIZEOF(
        QUERY ( x <* e.items | (('PLANT_FUNCTIONAL_DATA.' +
            'INFORMATION_CONTENT REPRESENTATION') IN TYPEOF(x)) ))) THEN
    RETURN(FALSE);
END_IF;
'custodian' : IF SIZEOF(e.items) <> SIZEOF(
    QUERY ( x <* QUERY ( y <* e.items | (
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(y)) ) | (x
        \product_definition.frame_of_reference.name IN [
            'physical definition','physical occurrence']) )) THEN
    RETURN(FALSE);
END_IF;
'operator' : IF SIZEOF(e.items) <> SIZEOF(
    QUERY ( x <* QUERY ( y <* e.items | (
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(y)) ) | (x
        \product_definition.frame_of_reference.name IN [
            'functional definition','functional occurrence']) )) THEN
    RETURN(FALSE);
END_IF;
'context for hierarchy' : IF SIZEOF(e.items) <> SIZEOF(
    QUERY ( x <* e.items | (
        'PLANT_FUNCTIONAL_DATA.PRODUCT_DEFINITION' IN TYPEOF(x)) ))
    THEN
    RETURN(FALSE);
END_IF;
'context for identification' : IF SIZEOF(e.items) <>
    SIZEOF(QUERY ( x <* e.items | (
        'PLANT_FUNCTIONAL_DATA.EXTERNAL_SOURCE' IN TYPEOF(x)) )) THEN
    RETURN(FALSE);
END_IF;
OTHERWISE : RETURN(TRUE);
END_CASE;
RETURN(TRUE);
END_FUNCTION; -- plant_functional_organization_correlation

FUNCTION plant_functional_person_correlation(
    e: plant_functional_person_assignment
) : BOOLEAN;
LOCAL
    p_role : STRING;
END_LOCAL;
p_role := e\person_assignment.role.name;
CASE p_role OF

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```

'designer'      :           IF SIZEOF(e.items) <> SIZEOF(QUERY ( x <* e.
    items | ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN TYPEOF(x)) ))
    THEN
        RETURN(FALSE);
    END_IF;
'checker'       :           IF SIZEOF(e.items) <> SIZEOF(QUERY ( x <* e.
    items | ('PLANT_FUNCTIONAL_DATA.ACTION_RESOURCE' IN TYPEOF(x)) ))
    THEN
        RETURN(FALSE);
    END_IF;
OTHERWISE      :           RETURN(TRUE);
END_CASE;
RETURN(TRUE);
END_FUNCTION; -- plant_functional_person_correlation

FUNCTION using_representations(
    item: representation_item
    ): SET OF representation;
LOCAL
    results          : SET OF representation;
    i                : INTEGER;
    intermediate_items : SET OF representation_item;
    result_bag       : BAG OF representation;
END_LOCAL;
results := [];
result_bag := USEDIN(item,'PLANT_FUNCTIONAL_DATA.REPRESENTATION.ITEMS');
IF SIZEOF(result_bag) > 0 THEN
    REPEAT i := 1 TO HIINDEX(result_bag) BY 1;
        results := results + result_bag[i];
    END_REPEAT;
END_IF;
intermediate_items := QUERY ( z <* bag_to_set(USEDIN(item,'')) | (
    'PLANT_FUNCTIONAL_DATA.REPRESENTATION_ITEM' IN TYPEOF(z) );
IF SIZEOF(intermediate_items) > 0 THEN
    REPEAT i := 1 TO HIINDEX(intermediate_items) BY 1;
        results := results + using_representations(intermediate_items[i]);
    END_REPEAT;
END_IF;
RETURN(results);
END_FUNCTION; -- using_representations

FUNCTION valid_time(
    time: local_time
    ): BOOLEAN;
IF EXISTS(time.second_component) THEN
    RETURN(EXISTS(time.minute_component));
ELSE

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        RETURN(TRUE);
    END_IF;
END_FUNCTION; -- valid_time

FUNCTION valid_units(
    m: measure_with_unit
): BOOLEAN;
IF 'PLANT_FUNCTIONAL_DATA.LENGTH_MEASURE' IN TYPEOF(m.value_component)
    THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(1,0,0,0,0,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.MASS_MEASURE' IN TYPEOF(m.value_component)
    THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,1,0,0,0,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.TIME_MEASURE' IN TYPEOF(m.value_component)
    THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,0,1,0,0,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.ELECTRIC_CURRENT_MEASURE' IN TYPEOF(m.
    value_component) THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,0,0,1,0,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.THERMODYNAMIC_TEMPERATURE_MEASURE' IN
    TYPEOF(m.value_component) THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,0,0,0,1,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.AMOUNT_OF_SUBSTANCE_MEASURE' IN TYPEOF(m.
    value_component) THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,0,0,0,0,1,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
```

```

        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.LUMINOUS_INTENSITY_MEASURE' IN TYPEOF(m.
        value_component) THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(0,0,0,0,0,0,1) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.PLANE_ANGLE_MEASURE' IN TYPEOF(m.
        value_component) THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(0,0,0,0,0,0,0) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.SOLID_ANGLE_MEASURE' IN TYPEOF(m.
        value_component) THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(0,0,0,0,0,0,0) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.AREA_MEASURE' IN TYPEOF(m.value_component)
        THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(2,0,0,0,0,0,0) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.VOLUME_MEASURE' IN TYPEOF(m.value_component)
        THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(3,0,0,0,0,0,0) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.RATIO_MEASURE' IN TYPEOF(m.value_component)
        THEN
        IF derive_dimensional_exponents(m.unit_component) <>
            dimensional_exponents(0,0,0,0,0,0,0) THEN
            RETURN(FALSE);
        END_IF;
    END_IF;
    IF 'PLANT_FUNCTIONAL_DATA.POSITIVE_LENGTH_MEASURE' IN TYPEOF(m.
        value_component) THEN

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IF derive_dimensional_exponents(m.unit_component) <>
    dimensional_exponents(1,0,0,0,0,0,0) THEN
    RETURN(FALSE);
END_IF;
END_IF;
IF 'PLANT_FUNCTIONAL_DATA.POSITIVE_PLANE_ANGLE_MEASURE' IN TYPEOF(m.
    value_component) THEN
    IF derive_dimensional_exponents(m.unit_component) <>
        dimensional_exponents(0,0,0,0,0,0,0) THEN
        RETURN(FALSE);
    END_IF;
END_IF;
RETURN(TRUE);
END_FUNCTION; -- valid_units
END_SCHEMA; -- plant_functional_data
```